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USSR Report

ENERGY

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JPRS-UEN-85-001

14 January 1985

USSR REPORT

ENERGY

CONTENTS

FUELS

OIL AND GAS

COAL

ENERGY CONSERVATION

OIL AND GAS

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AZERBAIJAN GEOLOGICAL, GEOPHYSICAL WORK ON LAND DESCRIBED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 1-6

[Article by A. N. Guseynov and A. M. Akhmedov (p/o Azneft' [State Association of the Azerbaijan Oil Industry]), S. G. Nadirov (AzNIPIneft' [Azerbaijan State Scientific-Research and Design Institute for the Oil Industry]) and Sh. S. Kocharli (Azneftegeofizika [Azerbaijan Oil Geology Trust]): "The Main Results and Directions of Azerbaijan SSR Geological Exploration and Geophysical Operations on Land"]

[Text] In 1981-1983 two oilfields--the Zardob in the Saatly-Geokchay area, with three deposits (in the Upper Cretaceous, Eocene and Maykop sediments), and the Tarsdallyar, between the Kura and Iori Rivers, with a deposit in the Middle Eocene--were discovered. The Zardob and Tarsdallyar were discovered and prepared for deep drilling by geophysical methods. The Zardob area is located to the northwest of the Muradkhanly field and has a geological structure similar to it. The Tarsdallyar field, a firstling in the interriverine area, is in the southeastern part of the Dzheyranchel synclinorium.

The 16th horizon of the PT [productive series] at the Kyurovdag field has been found to be oil-bearing, and the presence of oil has been confirmed for the PT's 4th horizon in the axial portion of the northwestern submergence and for the PT's 8th horizon to the southeast of the fold's pericline.

At the Kalamaddin field, a new oil deposit was found by hole No 16 in the PT's profile, below the horizons being developed. The reserves for the three upper horizons have been given a preliminary assessment and have been brought into commercial operation.

At the Pirsagat field an oil-and-condensate deposit of the PT's 7th horizon has been traced in a southeasterly direction (holes, 109, 107, 211 and 208). The presence of oil in the PT's 20th horizon at the Neftechala field and in the 18th horizon at the Karabagly field has been confirmed.

In the Kursangya area the boundaries of the oil-bearing area in the 6th and 8th horizons have been enlarged, and the 13th-15th horizons have been opened up in holes Nos 55 and 97. The latter, which are characterized by BKZ [lateral-log soundings] as being oil-bearing, have confirmed the prospects of the PT's lower horizons.

At the Muradkhanly field the oil-bearing area of Cretaceous effusive formations and of Eocene sediments in the southwestern direction (holes 39, 211, 203, 208, 210 and others) has been greatly expanded, oil and gas shows were noted when the lowermost strata of the Maykop suite were opened up by drilling, and an oil-bearing core was taken from volcanogenic Cretaceous in hole 202, which was laid at the far southwestern submergence of the uplift.

New geological data were obtained about the presence of oil in Eocene sediments of the Gyurzundag field, to the northwest of the Tarsdallyar in the Kura-Iori interriverine area.

As a result of the seismic exploration that has been performed, and taking drilling data into account, a number of local structures in Paleogene-Mesozoic sediments (see the figure) were discovered and prepared during deep prospecting drilling in the Kura depression.

Some of the local structural complications that have been discovered--the Karabat, Gishlak, Kargaly and others--have been evaluated by geological-profile forecasting operations (PGR's) as possible sections where deposits are present; deposit-type anomalies (ATZ's) were found there.

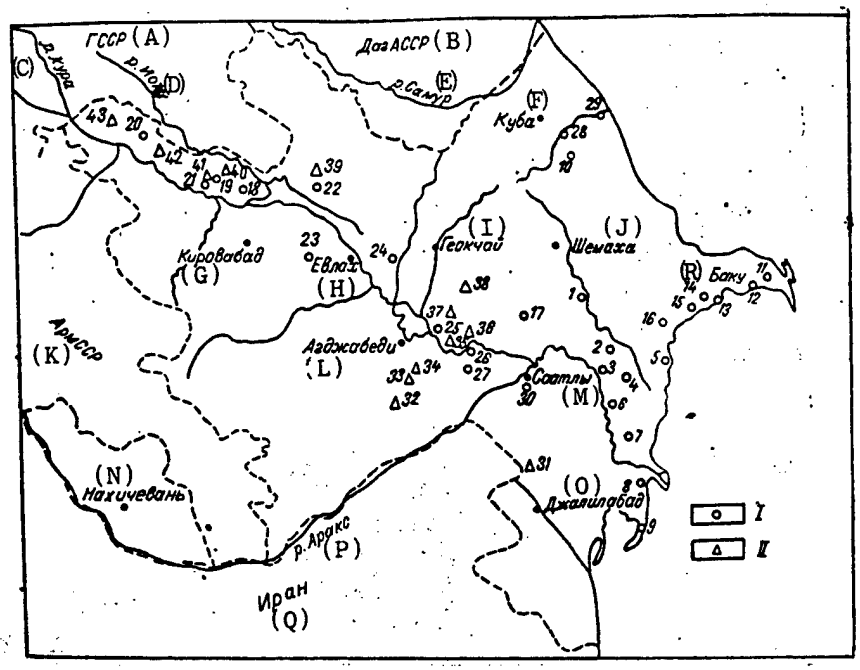
Important exploration results of 1983 were the discoveries of the Tarsdallyar field with an oil gusher that flowed at more than 200 tons/day from the Middle Eocene and the acquisition of commercial flows of oil from the Lower Om cross-section of the Maykop suite in the Zardob area that flowed at more than 80 tons/day, which will enable the Miocene-Paleogene trend to be introduced as promising throughout the Middle Kura depression.

This is confirmed also by the acquisition of commercial quantities of crude from the Eocene at the Amirarkh, Gedakbog and Damirtepe-Udabno areas, by intense oil and gas shows during well-drilling in sediments of the Maykop suite and of the Eocene at the Tarsdallyar and Gyurzundag areas, and by the acquisition of a commercial flow of gas from the Maykop suite in the Kaflandere area.

As a result of the processing of highly precise gravimetry data, and taking into account the data of seismic exploration on the Kura River's right bank in the Muradkhanly-Zardob region, YuzhVNIIgeofizika [Southern All-Union Scientific Research Institute for Geophysics] was able to forecast sections of thinning of effusive formations as possible zones of the spread of collectors.

During the period being examined the plan for increase in reserves was met 87.7 percent, this being ~8 percent more than during all the years of the 10th Five-Year Plan. The successfulness of exploration drilling as a ratio of the number of productive wells to the total number whose construction has been completed was rather high--70 percent (out of 58 holes completed by construction, 41 gave oil or gas). Nonfulfillment of the task of increasing reserves is explained by the lag in exploratory drilling, the planned indicators for which were realized by 79 percent for penetration, 80 percent for well-completion, and 77 percent for construction; and for wells that were to provide for growth in reserves--by only 36 percent.

Scheme of the Location of Fields and New Areas.



I. Under exploratory drilling in 1981-1983.

The Middle Pliocene trend:

1. Kalamaddin.
2. Mishovdag.
3. Kyurovdag.
4. Kyursangya.
5. Pirsagat.
6. Karabagly.
7. Babazanan.
8. Neftechala.
9. Kyzylagach.

The Miocene-Paleogene trend:

10. Siazan monocline.
11. Kala. 12. Gousany. 13. Bibieybat. 14. Lokbatan. 15. Karadag.
16. Duvannyy. 17. Zapadnyy Garasu. 18. Tarsdallyar. 19. Gyurzundag.
20. Sazhdag.

The Mesozoic trend:

21. Keyryukkeylan. 22. Adzhinour. 23. Gedakboz-Duzdag. 24. Amirarkh.
25. Zardob. 26. Muradkhanly. 27. Dzhafarly. 28. Talabi.
29. Agzybirchala. 30. Saatly SG-15000.

II. Prepared for prospecting drilling of the structure:

31. Agayeri. 32. Kebirli. 33. Yuzhnyy Agdzhabedi. 34. Akgel'.
35. Shikhbagi. 36. Shakhsuni. 37. Kargaly. 38. Myusyusli.
39. Makhmudli. 40. B. Palantekyan. 41. Zapadnyy Gyurzundag.
42. Molladag. 43. Dzhandargel'.

A. Georgian SSR. B. Dagestan ASSR. C. Kura River. D. Iori River.
E. Samur River. F. Kuba. G. Kirovabad. H. Yevlakh. I. Geokchay.
J. Shemakha. K. Armenian SSR. L. Agdzhabedi. M. Saatly.
N. Nakhichevan. O. Dzhalilabad. P. Araks River. Q. Iran. R. Baku.

The informativeness of exploratory drilling, particularly of coring, and the timely conduct of a set of GIS [downhole geophysical study], especially by the Gobustan URB [Exploratory Drilling Administration], which does prospecting and appraisal drilling in new areas, is low. This situation prevents the needed amount of reliable data from being obtained for studying sediments that have been exposed and their petroliferousness, even in the case of parameters of productive objects.

A systematic delay occurs in the buildup and introduction of new areas for exploratory drilling (3 areas were introduced under a plan for 12).

The areas and tasks of geological exploration for 1984-1985 and for the 12th Five-Year Plan are determined in accordance with new geological and geophysical data that are received, the degree to which the data have been studied, and the availability and degree of assimilation of potential resources in the various petroliferous regions and stratigraphic complexes. In this connection, land-based geological exploration in Azerbaijan will be performed, as previously, in three directions: the Middle Pliocene, the Miocene-Paleogene and the Mesozoic.

For the Middle Pliocene, prospecting and exploration will be continued in the Lower Kura depression in order to perform two main tasks: to search for oil and gas deposits in the lowermost strata (the 20th horizon and in similar suites of the lower section) of the PT within the fields that are being developed; and to search for deposits in lensing-out formations that form lithological stratigraphic traps on the side portions of the depression.

The degree of promise of the 20th and lower horizons of the PT are validated by the spread of analogs of interruption suites and the NKP and PK suites in sandy facies in offshore areas and the appearance of a commercial flow of oil and gas at the Pirsagat and Neftechala fields, and also in adjacent water areas of the Caspian Sea. Favorable geological and geophysical criteria are found at the Kyursangya and Kyursangya-yuzhnaya areas. However, in regard to practical solution of this task, which involves the drilling of wells 6,000-6,500 meters deep, the Azneft' Production Association has undertaken construction of only one hole, No 64 of the Kyursangya-Yuzhnaya, because of the lack of a BU-200-EIV.

The Kyzylagach underwater continental fold, which is the extreme southeastern element of the Kyurovdag-Neftechala belt on land, is considered promising in regard to the PT's lower horizons.

The existing geological and geophysical data show that Middle Pliocene sediments of enormous thickness (more than 4,000 meters), from the central portion of the depression toward its sides, that is, on the slopes of ancient fringing uplifts, are successively lensed out from below for a short distance, forming lithological stratigraphic traps.

It should be noted that the zones of stratigraphic lensing out are controlled locally by deep fractures, particularly from the southwest--the West Caspian deep fault.

A number of traps in this zone were found and prepared for drilling by seismic exploration: the Sarkhanbeyli, the Shorsulu and others, which have been evaluated by PGR and by gas-geochemical research as being possibly oil-bearing sections.

In the Lengebiz-Alyat uplift zone, the southeast side slope of the anticlinorium, which is marked by the presence of a number of gravitational anomalies, is of the greatest interest in searching for nonanticlinal traps. However, this region still has not been studied well by seismic exploration because of the complicated terrain. The choice of a specific target for prospecting drilling will depend upon the results of the seismic exploration being conducted here.

A small amount of work to outline oil deposits is planned for the PT's upper horizons at the Kyurovdag, Karabagly, Kyursangya, Neftechala and other areas.

In the Miocene-Paleogene and Mesozoic areas, the main volume of geological exploration and prospecting will be concentrated at the Yevlakh-Ardzhabedi and Iori-Adzhinour troughs. The Yevlakh-Agdzhabedi trough is marked by intense and stable submergence, which is compensated for by an accumulation of great thickness of oil and gas forming complexes of sediments of Mesozoic-Cenozoic age. In the side portions, the trough is complicated by ridges of effusive rocks of Cretaceous age (in absolute geochronology), which are enveloped invasively by Miocene-Paleogene sediments on the northeastern side and by Upper Cretaceous on the southwestern side. Under the action of erosive forces and fracture tectonics, the surface portion of the effusives has been marked by hillocks and is ripped up unevenly, causing the forming of secondary pores and cracks. These conditions predetermined saturation of the collectors with hydrocarbons from the enveloping oil and gas forming Miocene-Paleogene complex of sediments that fill the trough. This basic scheme for the forming of the deposits, which we have developed over the last decade, has been confirmed by the discovery of effusives of fields unique in their structure, such as the Muradkhanly, Zardob and others that are situated on the northeastern side of the depression.

In accordance with this concept, the morphological appearance of the volcanogenic base, the discovery of zones of the development of effusive uplifts and ridges on its surface, and the prediction that they are enveloped and overlapped by Paleogene-Miocene sediments are important prospecting criteria. Geological and geophysical research that has been conducted has established that these favorable conditions are inherent for the whole raised portion of the northeastern side of the trough--the Muradkhanly-Zardob-Amirarkh belt, where seismic and gravity exploration has revealed more than 10 similar local buried structures. In this connection, also of great prospecting interest is the forecast that there are zones of thinning---possible sections for collectors to develop in the effusives. The comparative results of highly precise gravimetric research in this direction is encouraging, and an expansion of this research is planned. Another important direction for prospecting in the Muradkhanly region is study of the petroliferousness of Eocene-Oligocene-Miocene sediments, whose commercial significance also has been established at the Muradkhanly and Zardob fields. Throughout the whole northeast side zone, the Paleogene sediments, in leaning toward the effusive ridge bodies, form stratigraphic traps, and, in some cases, local four-member anticlinal folds.

Seismic exploration here has traced zones of regional lensing-out and local traps have been mapped on their background. At a number of these traps ATZ sections which are of important practical interest have been discovered by the geological profile forecasting method.

Experimental-methodics testing-ground research for the discovery, mapping and evaluation of the petroliferousness of nonanticlinal traps continues here.

On the southwestern side of the Yevlakh-Agdzhabedi trough (in the Kirovabad region), a limited amount of drilling has been called for at the Sovetlyar, Agdzhabedi-yuzhnaya and Kebirli areas and an appraisal well at Shirvanly in the Upper Cretaceous and Eocene-Miocene sediments is to be drilled. The necessity for this work is dictated by an influx of oil that was obtained in past

years in emergency wells Nos 1 and 2 of the Sovetlyar area and in some Zhdanovsk-area wells from Maykop-suite sediments, and by seismic-exploration data newly obtained in the given region.

At the Kebirli area, where promising sediments are not deeply buried, the prospecting task will be resolved by structural-drilling prospecting.

The Kura-Iori interriverine area occupies the southwestern side portion of the Iori-Adzhinour trough, in which the Mesozoic-Cenozoic sedimentary complex, according to geophysical data, is more than 10 km thick. Previously conducted geological surveys and structural drilling on the oblast's land mapped more than 40 anticlinal structures in Pliocene-Miocene sediments, which were characterized by high degrees of dislocation, shattering by disturbances, overthrusting of the northern wings, and so on. These circumstances caused complexity of the seismological conditions for studying the tectonics of promising Eocene-Upper Cretaceous sediments.

During the 10th Five-Year Plan, in conformance with the program, drilling started on a section of appraisal holes, in unison with geophysical study thereof, in order to prepare structures and to further concentrate work in promising directions.

Seismic exploration by MOGT [common-depth point method] and drilling showed a more complicated geological structure for the Kura-Iori interriverine area: the presence of a number of large longitudinal fractures with an amplitude of more than 1,500 meters, sharp submergence of the surface of Eocene-Upper Cretaceous sediments to the northeast, the presence of overthrusts and diapir fold intrusions, a mixing of structural planes for different stratigraphic levels, a damping of several folds at depth, and so on.

MOGT seismic exploration made it possible to map and prepare the Sazhdag, Dzhandargel, Molladag, Gyurzundag, West Gyurzundag, Tarsdallyar and B. Palantekyan structures for drilling in Eocene-Upper-Cretaceous sediments. These local structural complications of the sedimentary cover often were confined to raised portions of the large Anticaucasus ridge maxima on the gravitational field, which reflects the deep structure of the district.

The distribution in this zone of coarse-debris collectors of the Middle Eocene has been confirmed by the drilling of holes in the Sazhdag, Damirtepe-Udabno, Mamedtepe, Gyurzundag and Tarsdallyar areas, but the lithological composition is not so different from the Samgori field in East Georgia and is characterized by interbedding with aleuropelite marls and by argillites.

Out of 15 well-drilling starts, the construction of only 4 were completed, of which 2 yielded output: No 1 of the Damirtepe-Udabno area, in which a flow of light crude was obtained with a flow rate of 5 m^3/day from an Eocene sediment, and No 1 of the Tarsdallyar area, which went into trial operation from the Middle Eocene as a gusher with a flow rate of 200 tons/day of crude.

In the Gyurzundag area, hole No 1 opened up sediments of the Middle Eocene with clear signs of the presence of oil. However, it was not possible to test the target because of collapse of the tubing string.

Because the Tarsdallyar field opened up with a high rate of flow of crude, a program was prepared that called for intensifying geological-exploration drilling and geophysical work in the Kura-Iori interriverine area.

On 1 January 1984 drilling was done in the eastern part of the interriverine region at the Tarsdallyar region (holes No 2 and 3), the Gyurzunda (hole No 3) and the Keyryukkeylan (hole No 1). It is planned to bring exploration meterage at areas in the interriverine district up to 30,000 meters in 1984 and 40,000 in 1985, to start drilling in the Tarsdallyar area with holes 4, 5, 6, 7, 10 and 11 and in the Gyurzundag area with holes 4 and 5, and to introduce the Molladag and B. Palantekyan areas to drilling.

The Adzhinour district occupies the southeastern part of the Iori-Adzhinour trough and is marked by the presence on the surface of more than 30 local structures, which have been mapped, mainly by geological surveying and partially by prospecting-structural drilling, and by the discovery of sediments of the Anthropogene-Pliocene and, in places, of the Upper Miocene, in the northern folded belt.

In past years gravimetric-magnetic and electrical exploration had been conducted in the region, but seismic MOV [reflected-wave method] exploration proved to be uninformative.

At the Adzhinour area, in the western portion of the region, drilling was started with appraisal hole No 1, which, at a depth of 3,655, entered just into Upper Miocene (the Meotis) sediments and was eliminated for technical reasons at a depth of 4,045 meters (the upper Miocene).

In recent years, in the western part of the Adzhinour, it has been possible, by seismic exploration by MOGT, and taking the data of hole No 1 into account, to prepare for drilling Upper Mesozoic sediments of the Makhmudli uplift with a dome isoline of 5,600 meters. An appraisal well 6,000 meters deep is to be drilled in this area.

However, seismic exploration in the Adzhinour district has not proved to be effective everywhere, because of the development of thick, coarse gravel formations (1,500-2,000 meters) and the rugged relief. Because of this, prospecting-structural holes are being drilled in order to study the structure of the upper structural stage down to the Miocene sediments and to exclude its distorting effect during seismic study of a number of profiles.

With a view to studying the cross-section and the possible petroliferousness of Eocene-Upper Cretaceous sediments and to obtaining data about the speed and density characteristics of the medium, an appraisal hole is to be drilled at the Ivanovskiy gravitational maximum to the east of Adzhinour.

Further prospects for developing oil recovery for the Azneft' Production Association are linked to a great extent with discovery of the petroliferousness of Mesozoic sediments of the Shemakhino-Gobustan region, where substantial forecasted oil and gas resources for this area are concentrated.

Seismic exploration (MOV, OGT [common depth point], and RNP [controlled directional reception]) performed in this district has proved to be uninformative because of the complexity of the tectonics of the upper structural stage (a strong degree of dislocation with fractures, the presence of diapir-type intrusions and mud volcanoes, the cover, and the great thickness and sameness of the profile of the overlapping complex), which adversely affected preparation of the area for the Mesozoic and the choice of specific sections for prospecting and exploratory drilling.

A number of appraisal holes were drilled through in recent years in Central and Southwest Gobustan in Mesozoic sediments, at structures that had been mapped for Neogene sediments--the Umbaki, Adzhiveli, Nardaran-Suleyman, Dashmardan and Kelany--which, at depths of 4,500-5,500 meters, did not emerge from the Oligocene-Eocene, confirming the fact of burial of Upper Cretaceous sediments at great depths.

In this connection, new appraisal holes are to be drilled in unison with a regional geophysical profile in Northern and Central Gobustan at the Astrakhanka, Leninabad and Sheytanud areas, where Mesozoic sediments in an autochthon and under the Paleogene hypothetically lie at comparatively lesser depths.

Methods testing that YuzhVNIIgeofizika performed in 1976-1979 by the wide-profile method (SShP) and later generalizations of gravimetric research also point to the presence of anomalies in the Sheytanud-Sherbitdag zone, where an appraisal well is to be drilled. The results of the drilling of these holes will enable the direction of further geological and geophysical studies to be determined.

Commercial petroliferousness of the Lower and Middle Miocene (the Umbaki, Adzhiveli, Duvannyy and others) was discovered previously in the southeastern part of the Shemakhino-Gobustan region--the Dzheyrankechmes depression, and the presence of sandy collectors in their profiles was established at the Dashgil, Solakhay and other areas. During the 12th Five-Year Plan prospecting wells are to be drilled here at known structures prepared by geophysics.

On the Apsheron Peninsula, the oil and gas resources of the productive series are practically explored, and all known fields are in the late stage of development. The hydrocarbon raw-materials reserves here can be increased only by opening up new deposits in sediments that underly the productive series, primarily in the Miocene. The petroliferousness of these sediments directly on the Apsheron Peninsula has been established in the western part of it, at the Karadag field with a comparatively high flow rate, and at the Binagadi, Sulutepe and Chakhnaglyar and other fields. Delineation drilling is being conducted at Karadag. Studies of recent years have indicated that on the Apsheron Peninsula, from north to south, clayey cross-sections of the Miocene are enriched by sandy varieties. An integrated program has been made up for intensifying geological exploration in the Miocene sediments, which calls for drilling solitary holes (1-2 each) at 14 fields for purposes of making a general assessment of the prospects of petroliferousness of the Miocene sediments.

Because of the highly industrialized buildup of the Apsheron Peninsula and the impossibility of conducting seismic exploration that will cover the industrial areas, these holes are being sited on the basis of the assumption that the structural layouts of the underlying sediments will coincide approximately in plan with those for the PT.

One well is now being drilled, but extremely slowly, at each of five fields (the Karadag, Lokbatan, Bibieybat, Gousany and Kala). It is planned to begin the drilling in 1984-1985 of five more fields--Kergez, Kushkhana, Atashkya, Turkyany and Zyrya. Exploration drilling will be performed at these and other fields in accordance with the results of the drilling of these holes in the Miocene insofar as they concern the lithology and petroliferousness of the indicated areas.

In the Caspian-Kuba region a small amount of exploratory drilling will be continued with a view to tracing the oil deposits of the Siazan monocline in the northwesterly direction. However, because of the great ruggedness of the land and its population density and the delays caused by this in the buildup of facilities in the area, this task is being resolved at a slow pace.

Prospecting the Mesozoic trend continues in the Talabi area and it is to be performed in the southeastern terminus of the Khizin sinclinorium, in the Sitalchay and Begimdag-Tegchay areas.

The Dzhalilabad region also is among the poorly studied lands of Azerbaijan, although the prospects there for petroliferousness in Miocene-Paleogene sediments has been confirmed by existing structural-mapping data from deep solitary holes and geological research performed on the southern side of the trough. It is difficult to perform seismic exploration here because of the ruggedness of the relief and the high state of land development after many years of agriculture. Exploratory drilling is planned for the Shirinsu, Tumarkhanly and Agdash areas, which are located at the northeastern fold belt of the Burovar anticlinorium, which forms the southwest side of the Dzhalilabad trough.

In the Nakhichevan ASSR, no signs of petroliferousness were observed in four previously drilled holes (Degnya-Velidag, Beyukdyuz and Negram) in the portions of the sediments of, respectively, the Devonian, Triassic and Miocene-Paleogene-Cretaceous that were opened up, and MOV-type seismic exploration proved to be ineffective. These limited data are not enough for evaluating the Nakhichevan ASSR's prospects. The 12th Five-Year Plan calls for a set of field geophysical research with the newest methods and equipment, in combination with appraisal drilling, with a view to studying the underground structure and to determining the promising areas for prospecting-type exploration.

In order to increase the effectiveness of geological exploration and geophysical work, to speed up the discovery of new fields (or deposits), and to carry out the plan for growth of oil reserves in 1984-1985 and for the 12th Five-Year Plan, it is necessary:

to overcome the systematic lag in exploration drilling and to provide for the fulfillment of annual plans for increasing oil reserves and for high-quality

completion of the drilling and construction of holes for the designed purpose, especially of plans that stipulated an increase in reserves, an anticipatory buildup and introduction of new areas to exploratory drilling, and timely solution of the geological tasks posed;

to continue to concentrate exploratory-drilling volume at promising areas of the Kura-Iori interriverine region--at Tarsdallyar, Gyurzundag, West Gyurzundag, B. Palantekyan, Molladag and Dzhandargel--with the involvement of the new areas in prospecting and exploration drilling as they are prepared by seismic exploration, bringing the meterage up to 30,000 meters in 1984 and 40,000 meters in 1985--and increasing it later during the 12th Five-Year Plan;

to drill primarily appraisal holes in the Dzheyranchel, M. Palantekyan, Kyasaman, Karadyuz, Chobandag, M. Udabno and Yayladzhig areas for the purpose of speeding up study of the geological structure of the interriverine region and high-quality preparation of new structures by seismic exploration for deep prospecting drilling;

to continue the delineation of discovered oil deposits and the search for new ones in Paleogene-Mesozoic sediments at the Muradkhanly and Zardob fields and in the Shikhbagi, Kargali, Karabat and other areas which have been prepared by seismic exploration;

to speed up study of the prospects for petroliferousness of the lower PT horizons at the Kyursangya, Pirsagat, Neftechala and other fields;

to intensify work on searching for oil in Miocene sediments at Apsheron Peninsula fields that are being developed;

to do anticipatory drilling of planned appraisal holes, in unison with geophysical research, in Gobustan, the Iori-Adzhinour trough, the southwestern side sections of the Yevlakh-Agdzhabedi and Dzhalilabad troughs with a view to discovering new, promising areas for prospecting, preparing structure in Mesozoic and Paleogene sediments, studying the lithostratigraphy, petrophysics, density and speed characteristics of their cross-sections, the stratification of seismic horizons, and so on;

to concentrate the main field geophysical research on searches for and preparation of structures in the most promising areas--the Yevlakh-Abdzhabedi and Yuri-Adzhinour troughs;

to bring 24-iteration profiling up to 100 percent in 1985, and to convert to 48-iteration profiling during the 12th Five-Year Plan;

to complete in 1984 the full conversion of seismic information to digital recording;

to organize 1-2 seismic parties, based upon transport equipment with high off-the-road capability for operation during the winter and in localities with complicated relief, with a view to achieving quality-standardized completeness of seismic observations in promising areas that are occupied by cotton plants and are difficult for vehicles to travel;

to increase the information content of exploratory drilling, especially at new areas of the Gobustan URB by coring and by comprehensive laboratory study of the cored material, the timely conduct of the mandatory set of field geophysical study of wells, and by the use of formation testers during the drilling process;

to improve the technology for touching down in a formation, design of the bottom-hole string assembly for intervals of complicated collectors which reveal themselves by loss of drilling solutions, with a view to preserving their capacitance and filtration characteristics, the methodology for interpreting GIS data, and physico-chemical methods for stimulating the bore area of the formation; and

to work out a methodology for preparing structures in the Shemakhino-Gobustan and Adzhinour regions, since a substantial portion of the forecast hydrocarbon reserves are concentrated here, and where, because of the complexity of the seismological conditions, the seismic exploration that has been conducted has proved to be ineffective.

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POSSIBLE PETROLIFEROUSNESS OF SOUTH CASPIAN UPLIFTS ANALYZED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 7-10

[Article by M. N. Asadov, Sh. A. Azizova and A. A. Narimanov (VPO Kaspmorneftegazprom [All-Union Caspian Offshore Oil and Gas Production Association]): "The Comparative Lithological and Petrographic Characteristics of Middle Pliocene Sediments of the Apsheron-Balkhan Area"]

[Text] The Apsheron-Balkhan uplift zone is one of the promising portions of the South Caspian. Here the Middle Pliocene is represented by Apsheron and Turkmen types of lithofacies, each of which has its own characteristic features. They are distinguished by different compositions and associations of their rock components, which are caused primarily by the presence of different sources that feed the province--the suppliers of terrigenic material to the sedimentation basin.

The lithofacies factor is one of the basic criteria in searching for oil and gas, and it plays an important role in determining the degree of promise of various areas and of various complexes of sediments.

From this point of view, studying the material content of the abovementioned types of lithofacies and making comparisons among them can be of practical interest when choosing areas for prospecting and exploration for oil and gas and when planning capital investment for the development of deep-water areas of the Apsheron-Balkhan uplift zone.

The targets of studies of the Middle Pliocene have been the structures: b. Zhdanova (103 samples), b. LAM (38), b. Gubkina (12) and b. Livanova-vostochnaya (17) of the Turkmen portion and Yuzhnaya-2 (45), Neftyanyye Kamni-2 (55) and imeni 28 Aprelya (87) of the Azerbaijan portion of the indicated zone.

As is known, in regard to the Cheleken subdivision, the redbed series (KT) of the Middle Pliocene is divided into separate horizons (1 to 8, inclusive). Below lie sediments that have been named the underlying series (PKT). Because of the lack of a continuous sampling and an inadequate number of cores, the description of the lithological and petrographic characteristics we have given is not considered to be correct for the individual horizons but for the KT and PKT cross-sections as a whole.

Based upon notions about the stratigraphic confinement of rocks of the PT [productive series], the KT and the PKT [5], and also the results of this work, a comparison of these rocks is made tentatively in the following order: sediments higher than the 8th horizon of the red beds from the Balakhan, Sabunchi and Surakhan suites, the 8th horizon of red beds from the interruption suite, and the PKT with the lower section of the PT.

Lithologically, the composition of the rocks above the 8th horizon of the KT and also of the Balakhan, Sabunchi and Surakhan suites of the PT was an alternation of clayey and sandy aleurite rocks.

According to the data of granulometric analysis, the following varieties of rocks are singled out: poorly graded clayey and sandy aleurolites, aleurite clays and "pure" clays. In these rocks, fractions greater than 0.25 mm are present in very insignificant amounts (less than 2.06 percent, 0.14 percent on the average).

The total carbonate content of this portion of the KT's cross-section exceeds somewhat that of the PT's. In PT rocks this content does not exceed 17.3 percent and it averages 10.5 percent, while in some red bed rocks its value reaches 45 percent and averages 17.5 percent.

Ore minerals--pyrite, magnetite and limonite, among which the most widely distributed is limonite--predominate in the mineralogical makeup of the heavy fraction.

A large amount of mica, chlorite, amphibole, epodite and zoisite are encountered in this part of the cross section of the red beds and the PT. Their content in the red beds is somewhat high. There is a small amount of stable nonferrous components present, of which the zircon and rutile content is greater in the PT rocks than in the red beds. Rarely, small amounts of titanite and pikotite are found. The presence of glauconite in an appreciable amount (up to 34 percent, an average of 9 percent) calls attention to itself, as does kyanite-staurolite (less than 6 percent, an average of 1 percent) in PT rocks, while glauconite (an average of 0.4 percent) and kyanite-staurolite (an average of 0.3 percent) are rarely encountered in red bed rocks and in a very insignificant amount, and rocks from the b. Livanova-vostochnaya area, where the glauconite (less than 39, an average of 24.5 percent) and kyanite-staurolite (less than 11 percent, an average of 6 percent) are present in a substantial amount [4 and 6], constitute an exception.

Quartz frequently is dominant in the mineral content of the light fraction of sandy aleurite rocks of both the PT and the red beds. Its average content in PT rocks (46 percent) is somewhat higher, and in KT rocks it does not exceed 39.6 percent (exceptions are rocks from the b. Livanov-vostochnaya area, where its maximum content reaches 93 percent and the average value is 69 percent).

The 8th horizon, as well as the Balakhan and the interruption suites, are lithologically represented by an alternation of clayey and sandy-aleurite rocks. In this part of the PT cross-section, the number of sandy formations is increased in comparison with the red beds.

According to the results of granulometric analysis of rock samples, the following varieties are singled out: khlidolite, sandy aleurite, aleuritic and clayey sands only in the PT, but in both series--subaleurolite, aleurite and aleuritic and "pure clay."

The amount of sandy fractions in the composition of the red rocks and their average grain size are less than what are found in the PT's.

In the red rocks at the b. Livanov-vostochnaya area, the sandy fraction content and the average grain size are similar to the structural characteristics of fragments of PT rocks.

The value of the total carbonate content of PT rocks varies from 3.6 to 25.9 percent. Its average value is low and does not exceed 7.7 percent.

The red rocks have more carbonate (an average of 20.5 percent). The mineralogical content of the heavy fraction of the PT, as well as the red rocks and the underlying series, is marked by an abundance of ore minerals, among which magnetite, ilmenite and limonite are contained in large amounts and invariably.

The pyrite content varies from isolated grains to 93.5 percent (sometimes it is entirely absent).

Large quantities of mica, chlorites and glauconite are noted from the nonferrous poorly stable components. Amphibole, augite, diopsid, epidote and zoisite are contained in insignificant amounts. The average value of the content of mica (6 percent) and chlorite (1 percent) in PT rocks is very low, while in the red rocks the amount thereof varies within the 4-60 percent range and averages 21.5 percent. Exceptions are rocks from the b. Livanova-vostochnaya area, in which their average values are, respectively, as in the PT, low (5 percent).

Glauconite is present in large amounts (up to 31 percent, an average of 5.5 percent) in the PT rock content, while in the red rocks it often is absent or is encountered in individual grains, very rarely as much as 5 percent. Exceptions again are rocks from the Livanova-vostochnaya area, in which glauconite is noted in a large amount (up to 39 percent, an average of 29 percent).

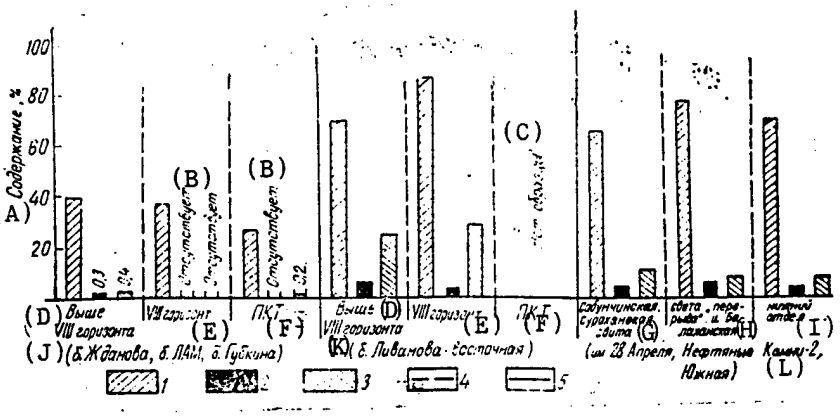
Stable nonferrous components (garnet, zircon, rutile and tourmaline) are present in insignificant amounts. Their greatest content is noted in PT rocks and in the b. Livanova-vostochnaya area [6].

Kyanite-staurolite paragenesis is present in an appreciable amount and invariably in PT rocks (up to 10 percent, an average of 4 percent), while in the red rocks they are nearly absent (except for rocks from the b. Livanova-vostochnaya area, where the average value thereof is 3.5 percent) (see figure).

In the mineralogical content of the light fraction of PT rocks, quartz sharply predominates (up to 90 percent, an average of 68 percent) over feldspars (up to 32 percent, an average of 14.5 percent) and over rock fragments (up to 45 percent, an average of 17.5 percent).

Rock fragments frequently predominate in KT rocks (up to 95 percent, an average of 47.4 percent). Exceptions are rocks from the b. Livanova-vostochnaya area, where quartz, the same as in the PT, always prevails (up to 93 percent, an average of 85.5 percent) above the remaining minerals of the light fraction [6].

Content of Minerals in Middle Pliocene Sediments.



1. Quartz.
2. Kyanite-staurolite.
3. Glauconite.
4 and 5. Boundaries between horizons and areas.

A. Content, in %.
B. Absent.
C. No samples.
D. Above the 8th horizon.
E. The 8th horizon.
F. PKT [the underlying series].
G. The Sabunchi and Surakhan suites.
H. The "interruption" suite and the Balakhan suite.
I. The lower section.
J. b. Zhdanova, b. LAM and b. Gubkina.
K. Livanova-vostochnaya.
L. Imeni 28 Aprelya, Neftyanyye Kamni-2 and Yuzhnaya.

The series that underlies the sedimentation and the lower portion of the PT is represented lithologically by an alternation of clayey and sandy aleurite rocks. According to granulometric-data analyses, all of their varieties are singled out in PT rocks, while rocks of the underlying series are related to families of poorly graded clayey aleurolites and aleuritic clays.

Rocks of the PT's lower portion are sandier and more aleuritic than similar rocks of the underlying series.

The total carbonate content of rocks of the underlying series (an average of 17.8 percent) is greater than for PT rocks (an average of 10.8 percent).

Within the sandy-aleuritic rocks of the red beds, the content of fractions larger than 0.25 mm (up to 1.39 percent, an average of 0.48 percent) and 0.25-0.1 mm (up to 18.33 percent, an average of 7.41 percent) is not great, while both the first (up to 26.72 percent, an average of 1.53 percent) and the second (up to 54.87 percent, an average of 22.63 percent) fractions are present in substantial amounts in the PT rocks.

The heavy fractions are marked by an abundance of ore minerals. Pyrite predominates in PK rocks, while in the underlying series limonite is present in large quantity, along with a substantial amount of pyrite.

The content of mica (up to 30 percent, an average of 15 percent) and of chlorite (up to 12 percent, an average of 5 percent) in the underlying rocks is greater than in those same rocks of the PT.

Amphibole, augite, diopsid, epidote and ziosite are encountered in an insignificant amount. Their content in the red beds is somewhat greater than in the PT rocks.

Glauconite is rarely encountered in PT rocks (less than 2 percent), but in PT rocks sometimes it reaches 29 percent, and it averages 6.5 percent. Invariably, nonferrous components (garnet, zircon, rutile and tourmaline) are encountered constantly, but in an insignificant amount. The content thereof in PT rocks is relatively large.

The presence of the kyanite-staurolite paragenesis in PT rocks is characteristic. It has been noted as high as 9 percent and it averages 2.2 percent.

In rocks of the underlying series these minerals are generally absent [4 and 6]. The mineralogical content of the PT's light fraction is characterized by a frequent predominance of quartz (up to 89 percent, an average of 68.7 percent) over feldspars (up to 31 percent, an average of 14.4 percent) and rock fragments (up to 68 percent, an average of 16.9 percent), while in rocks of the underlying series rock fragments often predominate (up to 94 percent, an average of 60 percent) over quartz (up to 65 percent, an average of 26 percent) and feldspars (up to 30 percent, an average of 14 percent).

As the abovementioned facts indicate, sediments of the PT, red-bed and underlying rocks in the areas we studied and in West Turkmenia [1-3], while having much in common, are distinct from each other to a certain extent. Exceptions are the red-bed rocks from the b. Livanova-vostochnaya area, which, in terms of lithology and petrography, have a clear resemblance to rocks of the Apsheron type PT.

Distinctive petrographic features of these sediments are: high sandiness, low carbonate content, a predominance of quartz in the content of sandy-aleuritic rocks, the presence of a large amount of glauconite, and an invariable and appreciable content of kyanite-staurolite paragenesis.

Thus, on the basis of what has been said above, it can be confirmed that rocks of the Middle Pliocene, which are represented by the Apsheron lithofacies type of sediments, have been distributed right up to the b. Livanova-vostochnaya area [7]. Consequently, in areas northwest of b. Livanova-vostochnaya, up to the Field imeni 28 Aprel', sandy-aleurite horizons below the foot of the Sabunchi suite, the whole Balakhan suite, the interruption suite and the NKP, PK and KaS suites can be of interest in the PT cross-section in searches for commercial accumulations of oil and gas.

Because of this, the development of designs for exploiting the area imeni 26 Bakinskiy Komissary, Promezhutochnaya, b. Livanova-zapadnaya and b. Livanova-tsentral'naya areas must be based upon a new notion about the type of the components of their rocks.

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TECTONIC STRESS ON STRUCTURES ALTERS FORMATION PARAMETERS

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 10-14

[Article by Zh. N. Ter-Karapetyants (IPGNGM [Institute for Problems of Deep Oil and Gas Fields], Azerbaijan SSR Academy of Sciences): "Change in Physical Parameters of a Formation Because of Tectonic Stress of the Structure"]

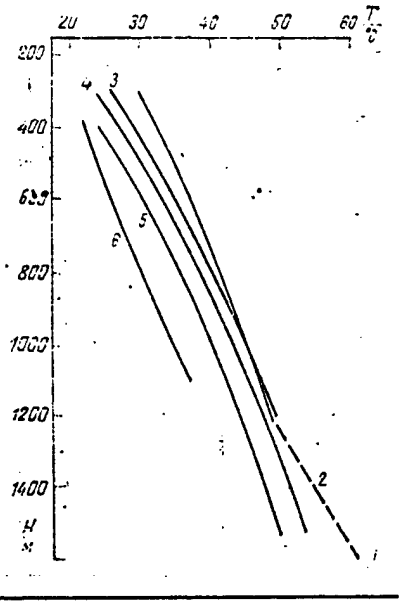
[Text] Change in values of open porosity ($K_{o.п.}$), permeability ($K_{пр}$) and temperature on the regional scale that are connected with stress on the structure that is caused by tectonic forces [3] is proved in this work in accordance with downhole study and the data of works [1, 2 and 4].

It has been established that under overthrusting conditions, azimuthal change in direction of a formation's strike and increase in the formation's dip angle, the values of $K_{o.п.}$ and $K_{пр}$ are reduced and the temperature rises. An analysis was conducted by comparing parameters by area and by adjacent field.

Figure 1 shows averaged values for the temperatures of fields of the Southwest Apsheron. It is evident from figure 1 that the greatest temperature values are observed at fields of the Yasamal valley and the Atashkya fields, in connection, respectively, with azimuthal change of direction of the formation's strike and with the overthrusting nature of the structure. At the Shabandag field (the Karadagneft' NGDU [Oil and Gas Recovery Administration]), which is a continuation of the Yasamal valley, the temperature values were 8-10 degrees C less by virtue of the absence here of the indicated tectonic elements. At the Lokbatan-Puta field the greatest temperature value was observed in the overthrust zone of the Lokbatan-pericline area, and the greater dip angles at the southern wing in comparison with the northern wing (table 1) have led here to an increase in temperature. The rise of temperature under the influence of overthrusting and the large dip angles of the formation are observed also, respectively, at the southern fold field of Artem Island and at Kyurovdag [2].

Tables 1 and 2 show the location of areas by suite for $K_{o.п.}$ and $K_{пр}$ in the area of increase in stress of the structure which is caused by the tectonic factor. Therefore, in table 1, the formation's dip angles are less in the upper line than in the lower one. It is evident from table 2 that the $K_{o.п.}$ and $K_{пр}$ values are less for all suites in the lower line than for those in the upper line. In the northern and central portions of the Yasamal valley,

Figure 1.



1. Atashkya. 2. Yasamal valley. 3. Lokbatan-pericline. 4 and 5. Lokbatan-north and Lokbatan-south wing. 6. Shabandag.

which have not been subjected to azimuthal change in the direction of the formation's strike, in contrast with its southern portion, the $K_{o.п.}$ value is identical. In the Yasamal valley and at Lokbatan-south, the $K_{o.п.}$ values in all the suites presented are determined according to coring data of the very same wells (Nos 32 and 752, respectively).

In table 2, despite the fact that the coring analyses of the stressed portion of the structure is in most cases tied to lesser depths, the $K_{o.п.}$ values retain the lesser value.

Let us note that, aside from the data shown in tables 1 and 2, a reduction of $K_{o.п.}$ and $K_{пр}$ from increase in the dip angles is observed for suites II, III, IV, V, KS and PK, when comparing the Buzovny-center area with the Mashtagi-south area (not including the wells located on the bend of the formation's strike in the Buzovny-center area). The values of $K_{o.п.}$ in suite VIII of the Atashkya area, in comparison with a similar suite of the Shubany area, where they are reduced by 5 percent (at depths of 330-400 meters), are connected with the horstlike nature of the Atashkya structure, that is, with greater tectonic stress.

Table 1

Field	Suite	Wing	$K_{o.п.}$%	$K_{пр}$, mkm²	Stratum dip angle, degrees
Balakhany-Sabunchi-Ramany.....	ПК$_в$*	Northeastern	24.5	0.75	15-16
		Southwestern	23.0	0.37	21-24
Lokbatan-Puta**.....	пVI	Northern	-	0.109	15-35
		Southern	-	0.057	25-55
	пVII	Northern	-	0.201	15-35
		Southern	-	0.057	25-55
Novaya Kushkhana	VIII	Southern	22.5	-	10-12
		Northern	20.5	-	45-50
Kyurovdag***.....	I	Northwestern	23.5	0.2	20-25
		Southwestern	21.0	0.1	45-50

*A similar phenomenon is observed for all six KS's.
**According to hydrodynamic-research data.
***For a cut-off of 2,500 meters.

Figures 2 and 3 show changes in $K_{o.п.}$ on Zhiloy Island in the Lokbatan area in reservoir-evaluation wells 1017 and 1018, which are located, respectively, in the tectonically quiet northern wing and in the overthrust zone. It is evident from figures 2 and 3 that a lower value is noted for $K_{o.п.}$ in the

Table 2.

Field	Suite	Wing	$K_{o.п.}$ %	$K_{пр}$, mkm²	Depth, meters
		Overthrust structure			
Artem Island..... (southern fold)	KS	Northeastern	26.0	-	700
		Southwestern	16.0	-	200
	ПК	Northeastern	29.0	-	650
		Southwestern	15.0	-	300
		Azimuthal change of the formation's strike			
Sulutepe.....	KS	Eastern	25.3	0.0125*	490-1,513
		Western	21.0	0.0038*	450-970
Karadag.....	пVII-x	Western	17.0	0.077	3,000-3,500
		Eastern	10.0	0.056	3,000-3,500
Yasamal'ska olyainda..	KS	Northern	18.0	-	2,000
		Southern	6.0	-	1,740
Lokbatan.....	пVII-x	Northern	22.5	-	1,200
		Southern	14.0	-	1,400

*According to hydrodynamic research.

overthrust portion of the structure than in the underthrust zone and $K_{o.п.}$ has a greater value in the area of no tectonic stress. A similar phenomenon had been noted previously in regard to the temperature parameter [2].

Despite the great sensitivity of the $K_{пр}$ parameter, its dependence upon the tectonic factor is also fixed by analogy with $K_{o.п.}$.

The established principle explains the observed anomalous phenomenon in which the compressing effect of geostatic pressure is not traced with depth for a similar suite: the $K_{o.п.}$ is reduced with reduction in depth, since the upper interval of the samples studied were located in the tectonic stress zone (see figures 2 and 3 and table 2). The spectrum of change in parameters was changed more with the overthrust nature of the structure and the azimuthal change in the direction of the formation's strike than with the steep angles of the formation's dip. Therefore, in the first two cases, an evident paradox is observed, wherein a reduction in $K_{o.п.}$ and $K_{кр}$ and an increase in temperature are noted at smaller dip angles of the formations, which is obvious when comparing the southern portion of the Yasamal valley with its northern and central portions, the Atashkya with the Shuban, and the Lokbatan-pericline with the Lokbatan northern, for in the first group the dip angles are one-half to one-third those of the second.

For a KS-type suite, the influence of the dip angles on change in $K_{o.п.}$ and $K_{пр}$ is telling in a lesser degree than for sandy suites because of the lithological changeability of the collector.

Where the formation has steep dip angles which are not functions of tectonic forces or sedimentation conditions, change in the parameters being examined

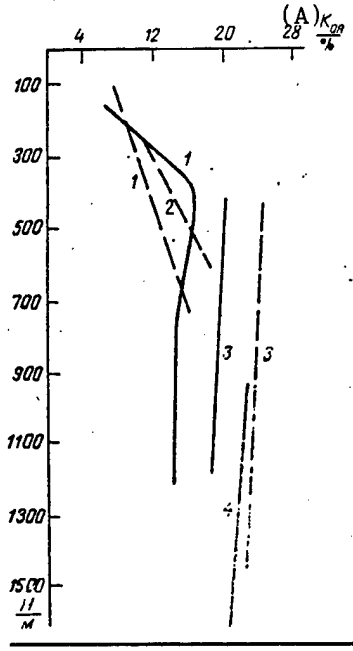


Figure 2.

Key:

— — — PK.

———— KaS.

1. Overthrust.
2. Underthrust.
3 and 4. Southwestern and northeastern wings.

A. K_{on}.

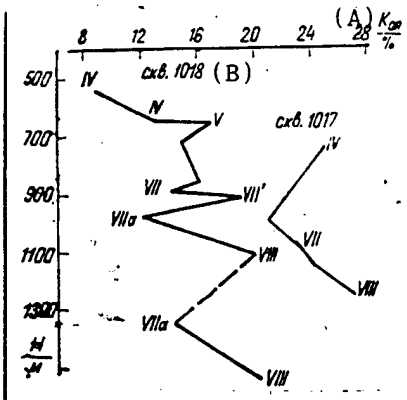


Figure 3. Lokbatan.

A. K_{on}.

B. Well No 1018.

will be unambiguous, for, with sediment accumulation on more ancient rocks that have sharp dip angles, the compactability of the sandstones rises.

Change in temperature as a function of the factors enumerated is observed where the temperature background is relatively calm and where the influence of a stronger factor, which, under Azerbaijan conditions is a "sealed" mud volcano, is absent.

The influence of stress of a structure on change in the enumerated parameters is observed irrespective of the dependence upon the trend of variability in clayeyness, given a relative lack of change in carbonate content within the field.

Statistical processing of $K_{o.n.}$ values for suites and horizons of the Lokbatan field (the northern wing and the pericline) and Atashkya showed that the root-mean-square deviation and the variation coefficient of $K_{o.n.}$ increase in tectonically stressed areas (Lokbatan-pericline and Atashkya).

In light of what has been said, when analyzing the main causes of AVPD (anomalously high formation pressure), greater priority should be given to the tectonic factor. Testifying to this in particular is the example of the strong oil gusher that was observed at the Lokbatan-pericline area when the 7th horizon was opened up by well No 45, which tells about the colossal formation pressures in the horst zone caused by tectonic stress. The appearance of AVPD at the Karadag field is explained, aside from the depth of the deposit, also by the stressed state that is created by a flexure-forming fold in a hydrodynamically closed system.

The influence of tectonic strains is traced not only to the $K_{o.n.}$ and K_{np}, formation pressure and AVPD. According to available data, the established natural consistency affects precisely change in value of the crude's density, the

grade-level of the oil-pool outline, the oil-yield coefficient, preservation of the well, the degree of oil saturation and development of the deposit, and the operation of the wells.

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SPECTRAL ANALYSES OF FLOW ENABLE WATER ENCROACHMENT FORECAST

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 14-16

[Article by R. A. Zeynalov (AzINEFTEKhIM [Azerbaijan Petrochemical Institute] imeni M. Azizbekov): "Early Diagnosis of the Start of Water Encroachment of a Gas Condensate Deposit"]

[Text] When operating gas-condensate fields and also when planning various geological-engineering measures, prediction of the start of water encroachment of a well's output is of great importance.

In this article, spectral analysis was used to solve this problem [1-3]. Its application was based upon the principle that any changes in the structure of time series will be observed in their spectral characteristics [4].

We shall present the work of a gas-condensate deposit through a time series of the flow of gas $V(t_i)$ and of gas condensate $Q(t_i)$ by one averaged well. These indicators are characterized by the ratio of total monthly recovery to the active well inventory.

We shall examine from these standpoints the operation of the Karadag gas-condensate field during the period 1955-1964. Water appeared in the well's output in October 1963.

The following scheme of computations was adopted.

For the existing time series $V(t_i)$ and $Q(t_i)$ for flow of the averaged well, spectral densities $G_v(f_i)$ and $G_Q(f_i)$ were calculated, as was the function of coherence $T^2_{V,Q}(f_i)$ for the first 6 years (72 points). In order to compute the indicated spectral characteristics, a program that was produced on the basis of the FORTRAN-ES language was used [1]. Later, both $V(t_i)$ and $Q(t_i)$ series were shifted ahead six time intervals, and, in so doing, the number of points subjected to analysis remains unchanged, that is, the segment chosen for analysis N = 72 "slides" along the whole time interval.

Thus seven series of computations were obtained. Tables 1 and 2 show the results of the computations. With a view to diagnosing the time that intense water movement started along the deposit, the absolute values of the deviations of spectral densities at the corresponding frequencies f_i were analyzed (table 3).

Table 1

Frequency f_i	Series number						
	1	2	3	4	5	6	7
	Spectral density $G_V(f_i)$						
0,083	0,363	0,395	0,401	0,376	0,204	0,126	0,067
0,166	0,121	0,140	0,146	0,141	0,147	0,097	0,047
0,249	0,327	0,380	0,376	0,373	0,296	0,205	0,076
0,332	0,432	0,486	0,477	0,453	0,386	0,283	0,167
0,415	0,258	0,208	0,244	0,253	0,159	0,067	0,226
0,498	0,304	0,311	0,302	0,310	0,267	0,203	0,161
	Spectral density $G_Q(f_i)$						
0,083	0,350	0,219	0,169	0,119	0,093	0,058	0,042
0,166	0,172	0,117	0,090	0,063	0,051	0,031	0,026
0,249	0,164	0,134	0,118	0,086	0,078	0,078	0,074
0,332	0,312	0,202	0,173	0,105	0,090	0,080	0,098
0,415	0,319	0,193	0,161	0,067	0,058	0,038	0,039
0,498	0,379	0,239	0,180	0,075	0,063	0,063	0,056

Table 2

Frequency f_i	Series number						
	1	2	3	4	5	6	7
	Coherence function $\gamma^2_{V,Q}(f_i)$						
0,083	0,254	0,167	0,283	0,738	0,742	1,0	1,0
0,166	1,0	1,0	1,0	0,949	0,508	0,388	0,673
0,249	0,796	1,0	1,0	0,808	0,245	0,249	0,677
0,332	0,540	0,807	0,739	0,655	0,170	0,175	0,437
0,415	0,615	0,655	0,614	0,744	0,574	0,539	0,378
0,498	0,791	1,0	1,0	1,0	0,668	0,256	0,165

Table 3

Series number					
1—2	2—3	3—4	4—5	5—6	6—7
Deviations $\S_n$					
0,032	0,006	0,025	0,172	0,078	0,059
0,019	0,006	0,005	0,006	0,050	0,021
0,053	0,004	0,003	0,087	0,091	0,038
0,053	0,009	0,024	0,067	0,103	0,057
0,050	0,036	0,009	0,094	0,092	0,020
0,007	0,009	0,008	0,043	0,064	0,042

Analysis of the maximal deviations $\S_n = G_n(f_i) - G_{n-1}(f_1)$, which are shown in table 3, permits the following conclusions to be drawn. A jump in absolute deviations of the spectra is observed in the fifth series (figure 1), that is, 6 months prior to the start of intense water encroachment of the wells.

Based upon an analysis of spectral-characteristics deviations, three basic types of structural changes in the system were discerned--stepped and linear growth and pulsed changes [4]. It is noted in this case that the numbers of the frequencies that correspond to the maximal deviations bear information about the type of qualitative changes. In our case, the maximal deviation $\S_4(f_1)$ is the low frequency that corresponds to qualitative changes in the system of the "stepped growth" type.

A similar conclusion can be drawn, based upon analysis of change of the coherency function. As follows from figure 2, the value $\S^2_{V,Q}(f_i)$ for the low frequency, beginning with the fifth series, grows sharply, while for the high frequency a reduction is observed.

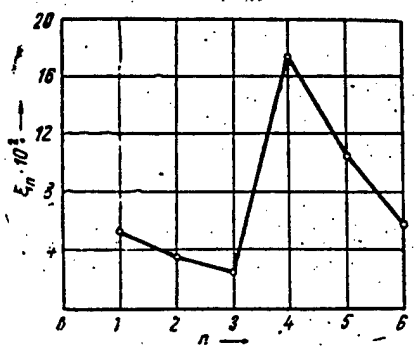

Figure 1.

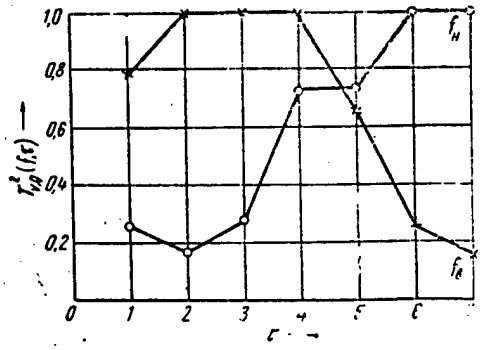

Figure 2.

The result obtained can be explained as follows: the appearance of water in the intensive-filtration zone would seem to correspond to the appearance of an "inertial element" in the interacting phases of the gas condensate, through which the time of mutual influence is increased.

Conclusions

In analyzing current spectral characteristics for the averaged well, one can judge the qualitative changes in the deposit.

The use of this method in the case of the Karadag gas-condensate field allowed start of the appearance of water activity to be diagnosed 6 months prior to its appearance in the well's output.

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ADJUSTED SOLUBILITY FACTOR A BETTER MEASURE OF GAS CONTENT

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 20-22

[Article by E. Sh. Aliyev, N. Sh. Shelevoy and K. V. Vinogradov [AzNIPIneft'):
"The Gas Content of Crudes in Place on Azerbaijan Land"]

[Text] The article generalizes many years of research in the area of the solubility of gas in Azerbaijan's oil in place. Experiments for studying crudes in place were conducted by the Thermodynamics of Reservoir Systems Sector, and previously by the Laboratory for the Study of Reservoirs and Fields of AzNIPIneft' [Azerbaijan SSR Scientific-Research and Design Institute for the Oil Industry], and they covered the period 1952-1983.

Originally the research was performed at installations that were based upon displacement of the fluid being studied by metallic mercury [1]. In 1965 conversion was made to mercury-free installations, and, since 1966, to the Oktan-1000 installation, which operated on a differential-free principle of suction and displacement that the institute designed and fabricated.

As a result of many years of research it was established that the properties of crudes in place, primarily the solubility of the gases in the crudes, changes to a much greater extent in the geographic plan than in the stratigraphic scheme (tables 1 and 2).

Maps of the distribution of solubility coefficient values for gases in crudes were made up for Eastern Azerbaijan as a whole (figure 1) and the Apsheron Peninsula (figure 2), including the adjoining portions of the Caspian Sea, in accordance with table 2 data.

As follows from figures 1 and 2, for the greater part of Eastern Azerbaijan the solubility of gases in crudes is 4-5 $m^3/(m^3 \cdot MPa)$. The average value of the parameter lies within these limits.

If the Apsheron Peninsula and the sea area north of it are excluded, then a trend toward a gradual reduction in solubility, from north to south, is observed completely accurately: from 6.4 $m^3/(m^3 \cdot MPa)$ at the Siazan monocline to 3.8-3.9 $m^3/(m^3 \cdot MPa)$ in the Muradkhanly and Neftechala areas. A typical case is the presence of a belt of reduced solubility--3-4 $m^3/(m^3 \cdot MPa)$, which stretches from the Adzhiveli fields through the north of Apsheron to Zhiloy Island, and which shifts sharply its zone of increased values of this parameter along the southern shore of Apsheron and the adjacent Caspian zone. Here the solubility coefficient values are 5-6 $m^3/(m^3 \cdot MPa)$, while in some

Table 1

Field	Horizon	Solubility coefficient $m^3/(m^3 \cdot MPa)$
Neftyanyye Kamni (southwestern wing)	NKP	4.39
	KC	3.91
	KC	4.61
	PK	4.30
	$PK_в$	4.25
	$PK_н$	4.63
	KaC	4.22
Kyursangya-severnoye	I PT	3.43
	II PT	4.10
	III PT	4.68
	IV PT	4.07
	V PT	4.42
	VI PT	3.97
	VII PT	4.69

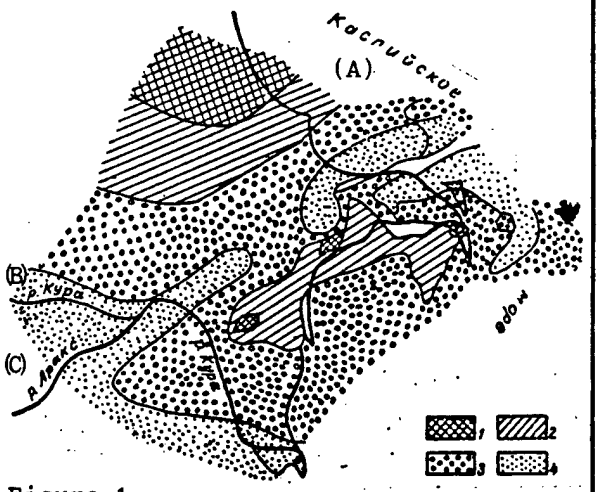


Figure 1.

1. 6-7 $m^3/(m^3 \cdot MPa)$.
2. 5-6 $m^3/(m^3 \cdot MPa)$.
3. 4-5 $m^3/(m^3 \cdot MPa)$.
4. 3-4 $m^3/(m^3 \cdot MPa)$.

A. Caspian Sea.
B. Kura River.
C. Araks River.

Table 2

Field	(1) $m^3/(m^3 \cdot MPa)$	(2) $m^3/(m^3 \cdot MPa)$
Muradkhanly	3.79	3.24
Siazan monocline	6.52	5.35
Neftechala	3.89	3.28
Kyursangya-severnoye	4.19	3.63
Kyursangya-yuzhnoye	4.27	3.70
Karabagly	4.28	3.36
Kyurovdag	4.54	3.81
Mishovdag	6.02	4.55
Kalamaddin	4.65	4.00
Umbaki	4.90	3.65
Adzhiveli	3.52	3.25
Pirsagat	5.38	3.88
Kyanizadag	5.82	4.66
Duvannyy-offshore	4.19	3.87
Puta	7.48	6.19
Lokbatan-severnoye	6.51	5.95
Lokbatan-yuzhnoye	6.90	6.33
Bibieybat	6.39	6.11
Binagadi	4.05	3.92
Masazyr	4.70	4.67
Sianshor	3.70	2.65
Kyurdakhany	3.43	3.20
Balakhany-Sabunchi-Ramana	3.87	3.52
Surakhany	4.03	3.94
Karachukhur	3.49	3.22
Gousany	4.57	4.47
Peschanyy-offshore	5.02	4.87
Bakhar	5.04	4.22
Zyrya	6.11	5.35
Buzovny-Mashtaga	3.02	2.89
B. Apsheronskaya	4.93	4.02
B. Darvina	3.42	3.17
Artem-severnoye	3.76	3.65
Zhiloy Island	3.95	2.67
Gryazevaya Sopka	3.57	3.37
Neftyanyye Kamni (severo-vostochnoye)	4.50	3.99

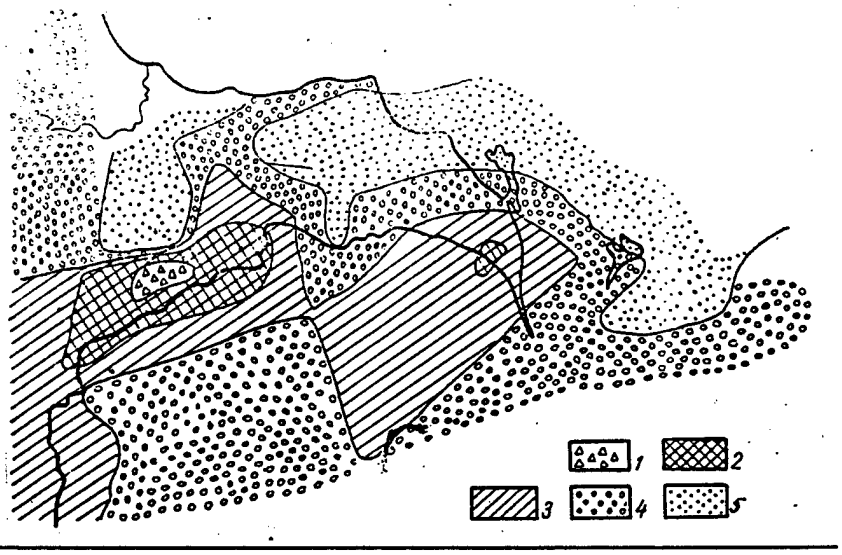
places they exceed 6 $m^3/(m^3 \cdot MPa)$--the regions of Bibieybat, Lokobatan and Puta and the fields of Zyrya and Mishovdag. The gradient of this parameter at the Adzhiveli-Puta section is especially great.

In the Northwestern Azerbaijan fields that are now being explored, one can expect roughly a high gas content--on the order of 6-7 $m^3/(m^3 \cdot MPa)$; this occurs both to the east, at the Siazan monocline, and to the west, in the adjacent zone of Georgia--the Samgori field.

In order to establish the variability of the crudes' solubility throughout the republic's territory, a parameter that can adequately characterize this feature must be chosen.

Figure 2.

1. 7-8 $m^3/(m^3 \cdot MPa)$.
2. 6-7 $m^3/(m^3 \cdot MPa)$.
3. 5-6 $m^3/(m^3 \cdot MPa)$.
4. 4-5 $m^3/(m^3 \cdot MPa)$.
5. 3-4 $m^3/(m^3 \cdot MPa)$.



It is known that the now generally accepted value that characterizes the gas content of a crude as a function is the coefficient of solubility for the oil and gas system, both phases of which are mixtures of different hydrocarbons, and this itself is a function of pressure. Therefore, the question arises of replacing this parameter by one that would not depend upon the variables associated with them, that, is, upon the pressure and gas content. The adjusted solubility coefficient, which considers the deviation of the oil and gas system from Henry's law, can be just such a parameter. This parameter was described in the work [2], where the dependence of the amount of solubility of the gas upon pressure (see figure 1) in the pressure interval of practical interest was described by the linear function

$$\Gamma = A_p + \Gamma_0,$$

where p is the pressure, Γ is the gas content of the liquid; A is the adjusted coefficient of solubility; and Γ_0 is the hypothetical gas content of the crude at normal pressure.

Table 2 shows, along with the true solubility coefficients, the adjusted coefficients, computed by field. The standard deviation for the first is 0.668, for the second it is 0.526.

Thus, the adjusted solubility coefficients are better correlated than the true ones. As for the distribution of this parameter about the territory and in the stratigraphic scheme, the qualitative picture here remains the same as for the true solubility coefficients, and, therefore, there is no necessity to present it on the map.

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SPECIFIC TOOL SEQUENCE FOR DEEP TURBODRILLING RECOMMENDED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 29-33

[Article by N. I. Nadzhafov (AzNIPIneft' [Azerbaijan Scientific-Research and Design Institute for the Oil Industry] and A. K. Babayev (Saatly NRE [Oil Exploration Expedition]): "The Question of Studying the Operation of KNBK's [Bottom-Hole Drill-String Configuration] for Superdeep Drilling"]

[Text] It is known that, in superdeep drilling, the question of warding off deviation of the borehole with a view to bringing the hole down to the designed depth is becoming especially important.

During the penetration of hole No 1-SG [superdeep], various members (ROP-9V type reamer-centralizers, TRS-9 stabilizers, and so on) were specified with a view to forestalling borehole deviation in the bottom-hole drill-string configuration (KNBK) used.

Meanwhile, the principle itself that had been adopted--hanging parts of the configuration below the turbodrill shaft, along with certain other deficiencies that negatively affected the stability of the well-bore's walls, turbodrill operation, and so on--was also complicated in each specific case by choice of the rational combining and deploying of members along the length of the configuration, which is required with a view to preventing bore-hole deviation.

Inclinometer measurements of the well bore (table 1) show that intense changes in the apex angle of the well bore, in the direction of both increase and decrease, were observed within certain intervals.

As is apparent from table 1, while stabilization of the curvature is within low limits in the drilling interval of 3,600-4,600 meters, sharp bends are observed in the well bore in the 4,600-5,010, 5,830-6,030 and 7,500-7,750 meter intervals.

With a view to generalizing the results of a test on the use of KNBK's and on determining the degree of influence of the KNBK on well-bore deformability, the operation of all KNBK's used in drilling hole No 1-SG was analyzed.

All KNBK's used in the 3,600-8,200 meter interval were grouped by component members and in accordance with the positions in which they were placed. Various KNBK's were used (48 groups in all) along the whole well bore, and, judging

Table 1.

Drilling interval, meters	Penetration,	Change in borehole apex angle From	To	Drilling interval meters	Penetration	Change in borehole apex angle From	To
3600—3850	250	0°30'	1°30'	6150—6290	140	5°30'	3°30'
3850—4075	225	1°30	1 30	6290—6485	195	3 30	3 30
4075—4225	150	1 30	3 15	6485—6870	385	3 30	4 30
4225—4235	10	3 15	2 30	6870—6940	70	4 30	3 15
4235—4375	140	2 30	4 15	6940—7100	160	3 15	3 00
4375—4520	145	4 15	2 30	7100—7480	380	3 00	5 45
4520—4600	80	2 30	2 30	7480—7500	20	5 45	4 15
4600—5010	410	2 30	7 30	7500—7750	250	4 15	9 30
5010—5215	105	7 30	5 30	7750—7825	75	9 30	9 30
5215—5750	535	5 30	6 00	7825—7980	155	9 30	11 15
5750—5830	80	6 00	8 15	7980—8000	20	11 15	10 30
5830—6030	200	8 15	3 30	8000—8035	35	10 30	11 45
6030—6150	120	3 30	5 30	8035—8170	135	11 45	9 45

Table 2.

A. KNBK [bottom-hole drill-string configuration No.
B. Penetration, meters.
C. Change in well's apex angle.
D. Increase.
E. Increase.

(A)	(B)	(C)	(D)	(E)
1	3 33—3710	77	0°30'	—
2	3710—3761	46	—	—
3	3735—3740	5	—	0 15'
4	3761—4860	151	—	0 45
5	3825—4576	266	—	2 15
6	3555—7484	10	—	0 30
7	3862—7481	124	0 25	—
8	3883—3981	21	0 15	—
9	3910—3912	2	—	—
10	3912—8086	143	0 30	—
11	3992—5128	229	2 00	—
12	4007—4200	39	—	0 30
13	4171—4854	80	2 00	—
14	4465—4922	33	—	0 45
15	4584—4800	172	2 15	—
16	4740—4777	15	—	—
17	4860—4861	1	—	—
18	4861—4940	61	1 15	—
19	4881—4885	4	—	—
20	4888—8103	19	—	0 30
21	4890—4894	4	0 15	—
22	4914—4915	1	—	—
23	4948—7610	52	1 15	—
24	5010—5162	15	—	0 45
25	5021—5190	74	0 30	—
26	5162—5263	10	—	—
27	5190—5278,5	41,5	—	1 05
28	5213—5830	147,5	0 20	—
29	5221—7752	562	—	2 50
30	5570—7923	208	1 30	—
31	5781—6208	143	1 05	—
32	5900—7955	89	—	1 05
33	6020—6151	13	—	0 10
34	6174—7982	897	0 40	—
35	6212—6779	306	0 45	—
36	6288—6290	2	—	—
37	6516—6550	34	—	0 30
38	6581—6883	23	0 15	—
39	6944—7666	34	0 40	—
40	7752—7773	21	—	—
41	7773—7915	106	1 15	—
42	7767—8080	42	0 30	—
43	7995—8060	24	—	—
44	7998—8022	24	1 00	—
45	8033—8074	31	—	1 30
46	8103—8154	51	0 45	—
47	8171—8200	29	—	—
48	8154—8218	35	—	0 30

by the results of their operation (table 2), we see that they had different effects on well-bore deformability.

Thus, while the apex angle of the borehole increased 2°00', 2°00' and 1°15' for, respectively, KNBK's Nos 11, 13 and 18, the use of KNBK's Nos 5, 29 and 32 helped to reduce the apex angle by, respectively, 2°15', 2°50' and 1°05'.

The use of KNBK No 34 (see table 2) helped to stabilize the borehole's curvature within low limits over a distance of 897 meters.

It was found that the use of MAG-type coring tools in the KNBK promoted an increase in bore-hole curvature. In the drilling interval 3,633-8,220 meters, using KDM coring tools in the KNBK, 2,769 meters were drilled (KNBK Nos 16, 24-37, 41, 43, 45 and 46), and, with MAG tools, about 216 meters (KNBK Nos 14, 23 38-40, 44 and 47). While using KNBK's with KDM coring tools the total change in apex angle (by way of reduction) was 1°15', while the use of a MAG coring tool increased apex-angle growth by 2°25'.

The negative effect of MAG coring tools on the status of the borehole is occasioned by the circumstance that they increasingly promoted tool deviation from the vertical because of eccentric installation of core receivers in them.

In all cases, use of the rotary drilling method promoted stabilization and reduction of borehole curvature, and, in so doing, total reduction of the borehole's apex angle was 4°30'.

As was noted above, TRS-9 stabilizers and ROP-9V type centralizer-reamers were used widely in the KNBK's during drilling. Table 3 shows the results of operation of all KNBK's in which TRS-9's and ROP-9V's were installed in various places.

Table 3

KNBK No.	Interval of KNBK use, (meters)	Penetration (meters)	Change in apex angle of the well's borehole	
			Increase	Decrease
TRS-9 installed above the turbodrill				
2, 11, 13, 17, 18, 20, 21, 24, 4, 45 and 47	3,710-8,000	539	3°45'	-
TRS-9 installed above the bit				
2, 9, 27, 28 and 32-37	3,710-6,550	1,578	-	1°05'
ROP-9V (TRS-9) installed above the bit				
7, 11, 15, 31, 39, 40, and 47	3,862-8,200	752	6°25'	-

As is apparent from table 3, the use of KNBK's in which TRS-9's were installed above the turbodrill promoted an increase in the borehole's apex angle by an average of 3°45' during drilling. Installation of the TRS-9 directly above the bit or above the ROP-9V centralizer-reamer, which was installed above the bit, influenced borehole deviation positively. In this case, the TRS-9 promoted stabilization of curvature within low limits over a distance of 1,578 meters (see table 3). The indicated benefit was occasioned by the fact that, with installation of the TRS-9 above the bit, the possibility of sidetracking the borehole in the bottom-well hole zone and deviation of the tool from the vertical were precluded (or reduced).

It was also noted that installation of the ROP-9V centralizer-reamer (without the TRS-9 above the bit (type ISM) promoted one-sided wear of the bit's side-cutting structure, deviation of it from the vertical, and borehole curvature (see table 3).

As was noted above (see table 1), in certain intervals sharp changes in borehole curvature--both increases and decreases--were observed. After KNBK operations were analyzed and generalized, it became possible to explain the causes of the indicated phenomena.

For example, the use of KNBK's Nos 11, 13, 18 and 21, in which a TRS-9 was installed above the turbodrill, and of KNBK No 15, in which the ROP-9V (without the TRS-9) was installed above the bit, caused intense increase in curvature, from 2°30' to 7°30' in the 4,600-5,010 meter drilling interval. The indicated KNBK's were used to drill 318 meters (77.3 percent) of the whole 410 meters of penetration (in the 4,600-5,010 meter interval), and, as a result, the curvature in the indicated interval increased by 6°15'. The remaining meterage (92 meters) was drilled through with other KNBK's (Nos 4, 10, 14, 16, 19, 22 and 23), which brought about a reduction in curvature of 1°15'.

In the 5,830-6,030 meter drilling interval, intense reduction of the borehole's apex angle from 8°15' to 3°30' was observed (see table 1). The reduction in curvature in the indicated interval was caused basically by the use of KNBK's

Nos 29 and 32, with which 133 meters (66.8 percent of all the meterage in the given interval) were drilled through. The curvature reduction in this case was 3°50', or 80.4 percent of the whole decrease in curvature in the 5,830-6,030 meter interval.

An increase of 5°15' in the borehole apex angle was observed in the 7,500-7,750 meter interval. In order to explain the causes of this phenomenon, table 4 compares the operating results for KNBK's used in the indicated interval with the operating results when these same KNBK's were used in the 3,633-8,218 meter interval.

Table 4

KNBK No	7,500-7,750 m			3,633-8,218 m			3,633-7,500-7,750-8,218 m		
	Penetration, m	Change in curvature		Penetration, m	Change in curvature		Penetration, m	Change in curvature	
		Increase	Decrease		Increase	Decrease		Increase	Decrease
30	40	1 10'	-	208	1°30'	-	168	0°20'	-
32	48	0 45'	-	89	-	1°05'	41	-	1°50'
34	84	0 50'	-	897	0°40'	-	803	-	0°10'
29	27	1 20'	-	562	-	2°25'	535	-	3°45'
23	21	0 30'	-	52	1°15'	-	31	0°45'	-
39	20	0 40'	-	34	0°40'	-	14	-	-

As is apparent from table 4, the total meterage drilled through and growth in curvature in the 3,633-8,218 meterval with use of the indicated KNBK's comprise, respectively, 1,842 meters and 0°35'. Meanwhile in the 7,500-7,750 meter drilling interval alone the increase in curvature was 5°15'. If this 7,500-7,750 meters is excluded from the 3,633-8,218 meter interval, then it is found that borehole curvature was reduced by 4°40' when the 3,633-7,500 and 7,750-8,218 meter intervals were drilled.

Thus, while the indicated KNBK's promoted a borehole curvature reduction of 4°40' in the 3,633-7,500 and 7,750-8,218 meter intervals, the curvature was increased by 5°15' in the 7,500-7,750 meter interval, using the same KNBK's.

This discrepancy testifies that this phenomenon is caused by other factors. While A7Sh turbodrills were used in drilling down to the 6,430 meter depth at the 6,430 meter depth, use also of the A7Sh-RM in alternation with the A7Sh began. From the 7,360 meter depth, the A7GTSh turbodrill was used instead of the A7Sh, that is, below the indicated depth only the A7Sh-RM and the A7GTSh were used, which promoted increase in the set of curvatures.

The indicated turbodrills are slow-running and, with a view to preventing borehole deformation,the load on the bit should have been restricted upon conversion to the indicated turbodrills. But actually, on the contrary, the load on the bit was increased because of the use of bits of new design below 7,500 meters, bits whose performance required high loads on them.

Conclusions

Hanging parts of the configuration below the turbodrill's shaft affects negatively turbodrill stability and operation and complicates choice of the required rational combination and positioning of the elements along the length of the configuration for the purpose of preventing borehole curvature.

The presence of a MAG-type coring tool in the KNBK acted adversely on the condition of the borehole

The installation of a TRS-9 stabilizer in the KNBK affects borehole curvature differently, depending upon its location. While installation of the TRS-9 above the turbodrill adversely affected borehole curvature in most cases, installing it directly above the bit, or above the ROP-9V centralizer-reamer (which was installed above the bit), prevented sidetracking of the borehole wall in the bottom-hole zone and deviation of the tool from the vertical.

The installation of an ROP-9V centralizer-reamer (without the TRS-9) above an ISM bit leads to one-sided wear of the bit structure, deviation of the tool from the vertical, and curvature of the borehole.

The use in well penetration of slow-running A7Sh-RM and A7GTSh turbodrills requires restriction of the axial load on the bit. Increase of axial load leads to intense increase of the borehole's apex angle.

With a view to stabilizing the borehole's apex angle within lower limits and preventing intensification of its growth, it is recommended that KNBK No 34 be used: bit or coring bit + ROP-9V + TRS-9 + KDM--6 meters + ROP-9V + turbodrill + UBT178-mm--21 meters + the drill strings.

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NEW SOLUTION FOR RESISTING WATER ENCROACHMENT PASSES TEST

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 34-36

[Article by A. I. Asad-Zade (NIPI Gipromorneftegaz [Scientific-Research and Design Institute of State Design Institute for Offshore Oil and Gas Industry Facilities]): "Results of Experimental Work on the Isolation of Water Influxes in Deep Oil Wells"]

[Text] Oilfields, including those occurring at depths of 3,000-5,000 meters, which are characterized by progressive water encroachment of the wells' output recently, have entered or will enter the late stage of development. Water has also encroached in wells at certain deep fields that are in the early stages of development. The prevention and limiting of water encroachment of wells at such fields is one of the most important problems.

The isolating fluids that are recommended for restricting water influxes in deep wells only partially satisfy the requirements posed. An isolating solution should possess selectivity, be light in viscosity (in order to penetrate into the bottom-hole zone at an injection pressure that is lower than hydrofracturing pressure), be temperature resistant, and resist washing away when stratal liquid arrives at the well.

In accordance with requirements that have been advanced, we proposed a new isolating fluid whose contents are sodium silicate 7 percent, alcohol 0.01 percent, water-soluble polymer 0.05 percent, and fresh water 92.94 percent. The proposed solution's isolating capability is based upon the fact that when it contacts the formation water it forms a gel, which later hardens and plugs the more permeable pores of the formation, which are the main routes for water breakthrough.

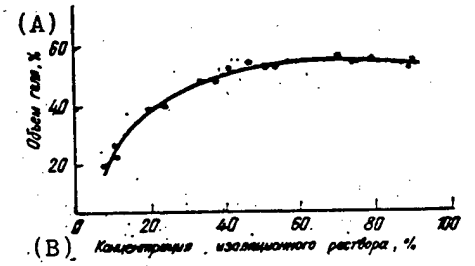
Laboratory research was conducted in order to assess the prospects for the use of the solution.

In particular, the following were studied: the degree of gel formation of the isolating fluid in stratal water, the solution's viscosity as a function of temperature, the effect of filtration velocity, formation temperature and the amount of filtered fluids in relation to the water-permeability values of the porous medium prior to and after injection of the insulating fluid into a model of the formation ($R_{ост}$).

Tests which studied the liquid's isolating capability were conducted at an installation that included a model of the formation, a temperature control system and a tank of compressed air. The formation model was saturated with formation water and its permeability was measured, after which the water was squeezed out by the isolating solution. In so doing, a gel was formed in the pores. Then process-water feed into the formation was renewed and, after the passage of more than 10 pore volumes, the permeability was measured. The results of the tests are shown in figures 1-4.

Figure 1 shows the change in gel volume in the formation water as a function of isolating fluid concentration. A maximum amount of gel is obtained with a definite ratio of water volume and isolating-solution volume. Later additions of the isolating liquid have no influence on increase in gel volume. At the same time, with the addition of formation water into the solution, gel forming occurs anew. The results obtained are of great practical importance. In particular, when isolating operations are planned, the amount of injected isolating liquid can be regulated for each specific target, depending upon the water-saturation of the collectors.

Figure 1.

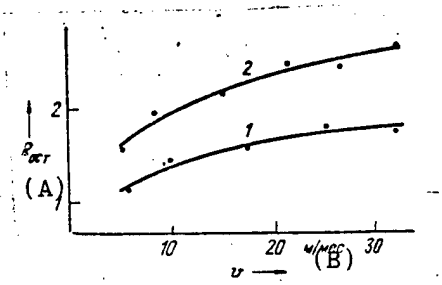


A. Amount of gel, percent.
B. Concentration of isolating water, percent.

Change in viscosity of the isolating solution and the formation water of the 8th horizon of the Sangachaly-offshore--Duvannyy-offshore--Bulla Island field as a function of temperature was studied. It was established that, with identical temperatures, the viscosity value thereof differed insignificantly. Consequently, isolating operations can be performed with this solution, even on targets with low permeability.

Figure 2 shows the value of the residual-resistance factor as a function of the liquid's filtration speed in the formation after the isolating operation. In order to compare the results obtained, similar tests were held also with an aqueous solution of polyacrylamide (PAA) with a 0.1 percent concentration. It is evident from figure 2 that the $R_{ост}$ value at first rises, with increase in speed for both solutions, then it has a tendency to stabilize, and the $R_{ост}$ value of the isolating liquid is, in this case, other conditions being equal, greater than the $R_{ост}$ of the polymer solution, an indication of its stability during filtration of the liquid.

Figure 2.



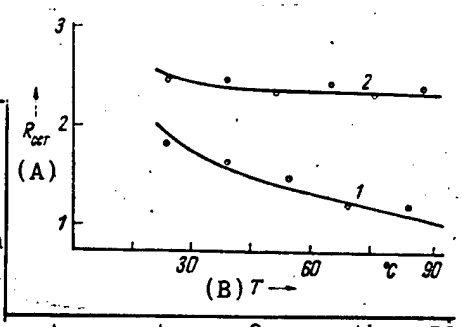
1 and 2. Results of tests with, respectively, an aqueous solution of PAA [polyacrylamide] and the isolating solution (the notation here also applies to figures 3 and 4).

A. Residual resistance.
B. Meters/month.

The $R_{ост}$ of the isolating liquid and the aqueous PAA solution as a function of formation temperature is shown in figure 3. As is apparent from the figure, as the formation temperature increases, the isolating capability of the aqueous PAA solution decreases sharply, while, at the same time, the isolating solution's $R_{ост}$ does not change. This factor enables this solution to be used for the selective isolation of water in wells with high formation temperature.

Figure 3.

A. Residual resistance.
B. Temperature

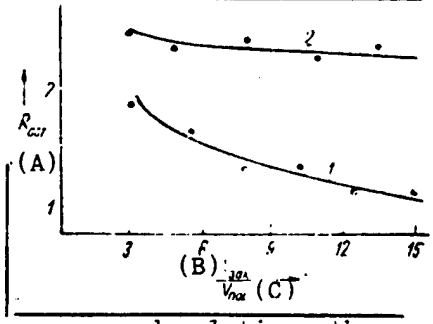


One of the main factors that determine duration of effectiveness in isolating water influxes is the amount of liquid taken from the formation after the isolating work is done. This is because, when liquid is filtered from the formation after the isolating operation, isolating material is gradually squeezed out. The squeezing out phenomenon is more appreciable in formations with a temperature of more than 50 degrees C.

Figure 4 shows change in $R_{ост}$ value as a function of the amount of liquid filtered, expressed in fractions of pore volume. The tests were conducted with the isolating solution and the aqueous PAA solution.

Figure 4.

A. Residual resistance.
B. $V_{зак}$ [injection volume].
C. $V_{по}$ [pore volume].



It follows from figure 4 that, as the fluid filters after the water is isolated by PAA, the $R_{ост}$ value is gradually reduced, approximating the initial value, while, when the water is isolated by the proposed solution, it drops only insignificantly at first, and then it stabilizes. Thus, with use of the proposed solution, the isolation is more stable than with use of the aqueous PAA solution, allowing the time between repeat isolating operations to be increased.

The results of the laboratory tests were verified at three gaslift wells of the Sangachaly-offshore--Duvannyy-offshore--Bulla Island field. After isolating operations, oil recovery per day for these wells rose 2.2-fold, and amounts of produced water and working gas were reduced, respectively, 2.1-fold and 1.3-fold.

Thus, the laboratory tests established that the proposed new solution for the selective isolation of water influxes into oil wells that have high formation temperatures and pressures possesses stability in the porous medium at different filtration speeds, formation temperatures and displacing fluid volumes

after isolation. A test of the proposed solution in deep oil wells showed that it is effective for isolating water influxes.

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LOCAL RESISTANCES AS BOTTOM-HOLE PRESSURE FACTOR DISCUSSED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 36-38

[Article by Z. Ya. Abbasov (IPGNGM [Institute for Problems of Deep Oil and Gas Fields] of the Azerbaijan SSR Academy of Sciences): "Consideration of Local Resistances When Computing Bottom-Hole Pressure in Operating Gas and Gas-Condensate Wells"]

[Text] It is known that a moving flow experiences local resistance when a flow section is suddenly narrowed. In the hydraulics of incompressible liquids this fact is considered by local-resistance coefficients, which are determined empirically, mainly. For gas influxes, local resistances have not been studied adequately. In particular, in the practice of computing bottom-hole pressure for dual-completion gas and gas-condensate wells (see figure), local resistances are disregarded [1] and the movement of gas from the bottom-hole to the well mouth are described by averaged data.

The practice of using recurrent ratios in bottom-hole pressure computations and a new methodology for computing pressure in operating gas and gas-condensate wells [2 and 3] will enable local resistances in dual-completion lift to be considered without an empirical study of a model.

As is apparent from the figure, the channel's flow section is constricted at the shoe of the first and second rows of pipes. The splitting of the flow must be considered in case of recovery of output over two channels.

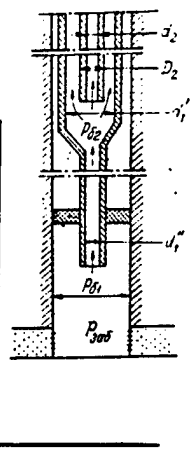
Let us write an equation of continuity for gas flow in the well:

$$q = \frac{p_0 M v_0}{RT_0} = \frac{pMFv}{RTZ} = \frac{p_c MF_c v_c}{RTZ_c}, \qquad (1)$$

where q is the large-scale consumption of gas (or gas and condensate mix); Q is the flow rate (volume throughput) of the gas, adjusted for the normal values of pressure p_0 and temperature T_0; M is the molecular weight of the gas (or the gas-condensate mix); R is the universal gas constant; p, F v, T and Z. are, respectively, the pressure, cross-section area, speed, absolute temperature and compressibility coefficient of the gas in the stream prior to the constriction; and p_c, F_c, v_c and Z_c are the pressure, cross-sectional area, speed and compressibility coefficient of the gas in the constriction zone.

In equation (1) we disregard change in temperature during constriction.

Typical Design of Underground Lift in Gas and Gas-Condensate Wells



The law of change in amount of motion per unit of time for the stream can be written in the form

$$F_c(p - p_c) = q(v_c - v). \qquad (2)$$

Taking (1) into account, equation (2) takes the form

$$(p - p_c) F_c = \frac{p_0^2 M\ {}_0^2 Z_c T}{R T_0^2 p_c F_c}\left(1 - \frac{p_c}{p}\frac{Z}{Z_c}\frac{F_c}{F}\right). \qquad (3)$$

Solving (3) for p leads to an equation of the second order, for whose solution we take the root, based upon practical considerations:

$$p = A + \sqrt{A^2 - \frac{p_0^2\ {}_0^2 MTZ_c}{RT_0^2 F_c F}}, \qquad (4)$$

where

$$A = \frac{p_0^2\ {}_0^2 MTZ_c}{2RT_0^2 F_c^2 p_c} + \frac{p_c}{2}.$$

Taking into account the computed magnitudes of the values of p_0, T_0, and R and dimensions of the flow rate and pressure outside the system, formula (4) takes the form:

$$p_б = B + \sqrt{B^2 - \frac{C}{a^2}}, \qquad (5)$$

where

$$B = \frac{C}{2 d_c^2 p_c} + \frac{p_c}{2};\quad C = \frac{\zeta\ {}_0^2 MTZ_c}{3{,}08\, d_c^2}.$$

Calculation of bottom-hole pressure, taking local resistances into account, is carried out in several steps.

First we determine the pressure above the shoe of the second row of pipes (p_c) in accordance with well-mouth parameters for well-operation mode and according to the methodics of [3]. Where output is withdrawn over two channels and the separate flow-rate measurements are lacking, distribution of total flow rate by stream is carried out. At the second stage, the shoe pressure of the second row of pipes ($p_б$) is refined in accordance with formula (5).

Next we repeat the calculation of the pressure p_c according to the methodics of [3] for the lower step of the first row, and, we calculate the shoe pressure of the first row according to formula [5], and then again, according to the methodics of [3], we determine the bottom-hole pressure.

The pressure for operating gas-condensate wells of the Bulla-offshore field (see the table) was calculated by way of approving the methods for considering local resistance. Wells with withdrawal of output over only a second or a single row of pipes were adopted for the computations. This enabled the methods of [2] to be used and the shoe pressure of the second row of pipes to be determined for the static column of gas in the casing-tubing annulus as a control. As is evident from the table, the results of the computation, taking local resistances into account, will enable calculation error to be reduced, although the pressure losses in local resistances are not great.

(A) Номер скважины	(B) Конструкция лифта		(C) Дебит		(D) Давление измеренное, МПа		(E) Температура, °С		(F) Давление расчетное, МПа		
	(G) I ряд	(H) II ряд	(I) газа, тыс. м³/сут	(J) конденсата, т/сут	(K) на буфере	(L) на кольце	(M) на устье	(N) на забое	(O) без учета местного сопротивления	(P) с учетом местного сопротивления	(Q) по статическому столбу
9	100-мм—1800 м 63-мм—3000 м	63-мм—1700 м	322,4	23	11,8	12,8	25	94	14,11	14,12	14,7
14	100-мм—1550 м 63-мм—3016 м	63-мм—1500 м	271,7	16	10,0	11,0	24	88	11,67	11,68	12,4
28	63-мм—5104 м	—	840,4	182	13,9	15,1	37	96	23,38	23,43	24,37

A. Well No.
B. Lift design.
C. Flow rate.
D. Measures pressure, MPa.
E. Temperature, degrees C.
F. Computed pressure, MPa.
G. Row I.
H. Row II.
I. Gas, thousands of m^3/day.
J. Condensate, tons/day.
K. On the buffer.
L. On the ring.
M. At the well mouth.
N. At the bottom hole.
O. Without taking local resistance into account.
P. Taking local resistance into account.
Q. For a static column.

Thus, the development of methods for computing the bottom-hole pressure of operating gas and gas-condensate wells, taking actual design of the lift into account, has been completed. It has been confirmed that, for the pipe diameters used in practice, pressure losses based upon constriction can be disregarded in a first approximation. An analysis of formulas(1)-(5) will enable the influence of various factors on the magnitude of the losses to be considered and the problem of considering local resistances for each concrete case to be solved.

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STABILITY OF UNANCHORED OFFSHORE PLATFORM SUPPORTS DISCUSSED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 39-41

[Article by F. S. Samedov and R. A. Gadzhiyev (NIPI Gipromorneftegaz [Scientific-Research and Design Institute of the State Design Institute for Offshore Oil and Gas Facilities]): "Evaluation of the Stability of Unanchored Support Modules for Offshore Stationary Platforms During the Erecting Period"]

[Text] When designing offshore stationary platforms, the requirements should be determined and solutions should be found for insuring stability of the support modules during the erecting operations.

A check on the positional stability of unanchored support modules for offshore stationary platforms should be made in accordance with a second group of limiting conditions, which consider the loss of stability as a result of deformation of the seabed soil on which it rests.

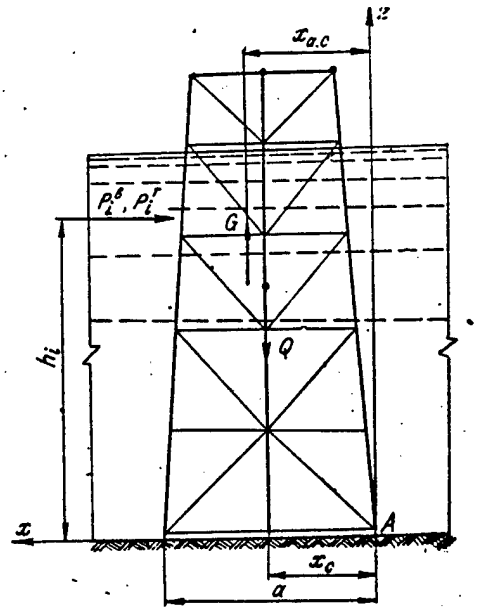
As analysis indicates, loss of stability of support modules that spend a lengthy period in the unanchored state is caused by an aggregate of many factors, the most important of which are the lengthy effect on them of wind and wave loads and currents of alternating sign, combined with uneven washing of the soil by the bottom currents. Losses of stability, as a rule, break out after the settling of one side of these structures, which is caused by disturbance of the soil-foundation skeleton under an overloaded part of the constructional structure.

It is recommended that, when designing offshore stationary platforms, they be oriented in such a way that the structure will absorb the smallest loads in the direction of the prevailing winds and intense wave action. In special cases, when the structure must be sited beforehand or because of important operating requirements, for example, when it must be attached to another oil or gas field structure, the platform's orientation must be subordinated to this requirement.

The stability of position of support modules not anchored to the seabed should be calculated at standard loads, with overload factors but without a dynamic coefficient. In so doing, the loads and effects should be assumed for the most unsuitable situations during erection, and, for support modules of asymmetrical constructional structure--in the direction of the least stability thereof.

The figure shows a calculated scheme for a support module not anchored to the sea bottom during erection.

In order to achieve high technical and economic design indicators, it is recognized as desirable that the stability of the support modules be verified, based upon effects that are 25 and 40 percent of the maximum possible effects (at sea depths of, respectively, less than 40 meters and more than 40 meters).



The calculation of stability against overturning of unanchored support modules, as for a constructional structure with concentrated support (at various points), must be performed in accordance with the condition of equilibrium that is proposed: the value of the maximum restraining moment should be 1.4-fold greater than the greatest value of the overturning moment that is calculated.

When designing specific structures, the stability of the support modules should be verified in accordance with the formula

$$\kappa_{уст} = \frac{M_{уд}}{M_{опр}} \geqslant 1{,}4, \qquad (1)$$

where $M_{уд}$ is the restraining moment relative to point A (see the figure) in regard to the support module's own weight Q, taking into account the structure's loss of weight in the water G; $M_{опр}$ is the overturning moment relative to point A from external effects (waves, wind and current).

In the general case, for an asymmetric support-module design and with nonuniform reception of ballast by the constructional-structure elements, $M_{уд}$ will be

$$M_{уд} = Q x_c^1 - G x_{a.c}. \qquad (2)$$

Where the application of these loads on the corresponding components are equivalent

$$M_{опр} = \kappa \sum P_i^в h_i + \sum P_i^т h_i, \qquad (3)$$

(3)

where k is the coefficient that considers the erecting conditions at sea: k = 0.25 where the sea depth is less than 40 meters, and k = 0.4 where the sea depth is more than 40 meters; h is the distance from the center of the components (point of application of equivalent loadings from waves and wind $P_i^в$ and of current $P_i^т$) to the seabed (point of overturning A).

The wave and wind loads should be determined for stormy conditions, with 1 percent to spare; P_i^T are the values of the loading from the current, which are determined in accordance with the specifications of the current in the area of construction.

In determining the wave load, it is recommended that the possibility of marine growth on the underwater members of support modules be disregarded. In this connection, it is recommended that the values of the coefficients of the resistances of inertia and velocity be adopted in the calculations as

$$C_{xc} = 0{,}75 \text{ и } C_{xи} = 1{,}5.$$

In checking the stability of the support modules, a possible lessening of the steady load (from the support module's own weight, and so on), which degrades the working of the constructional structure for overturning, should be considered by the overload coefficient $k_п = 0.9$.

For practical calculations, the coordinates of the center of gravity of asymmetric support modules can be determined with an adequate degree of precision with the following formulas

$$x_c = \frac{\Sigma P_i x_i}{\Sigma P_i}; \quad y_c = \frac{\Sigma P_i y_i}{\Sigma P_i}, \tag{4}$$

where P_i is the various constructional-structure members' own weight

or
$$P_i = q_i (l_i) \tag{5}$$
$$P_i = 7{,}85 F_i (l_i)_p,$$

where F_i is the cross-sectional area of the members; $(l_i)_p$ is the computed length of the bars, which is taken from the working drawings, or is determined by the formula

$$(l_i)_p = \kappa_i l_i,$$

where l_i is the geometric length of the members; k_i is the coefficient of conversion of the geometric length of the member into the calculated length.

For posts or continuously joined members $k_i = 1.0$; for braces and crossbars $k = 0.9$ to 0.95; and x_i and y_i are the coordinates of the center of gravity of the various constructional-structure members.

Constructional-structure weight losses in the water can be determined in accordance with the expression:

$$G \quad \Sigma \frac{\pi D_i^2}{4} \gamma (l_i)_p + \tag{6}$$
$$+ \Sigma F_i \gamma (l_i)_p + \Sigma V_n \gamma,$$

where D_i is the diameter of the closed tubular members, braces, struts and crossbars, diaphragms, and so on; T is the bulk density of the water; F_i is the cross-sectional area of open members; V_n is the volume of additional constructional-structure members (anodes, gusset plates, and others).

In the general case, the center of action of the force that is caused by the structure's loss of weight in the water does not coincide with the support module's center of gravity. The coordinates of the equivalent forces can be determined in accordance with the expression

$$x_{a.c} = \frac{\Sigma \frac{\pi D_i^2}{4} \gamma (l_i)_p x_i^2}{\Sigma \frac{\pi D^2}{4} \gamma (l_i)_p} + \\ + \frac{\Sigma F_j \gamma (l_j)_p x_j}{\Sigma_{.j} \gamma (l_i)_p} + \frac{\Sigma V_n \gamma x_n}{\Sigma V_n \gamma}. \quad (7)$$

In order to insure stability of the support module in the open sea, in certain cases, prior to performing the main operations for erecting pile footings, the support module is anchored to the seabed by driving corner piles. In so doing, the length the pile is driven should be set to take into account the need for absorption or extracting forces, which are determined from the expression:

$$l_{выд} = \kappa_n \frac{M_{опр} - M_{уд}}{an} 2, \quad (8)$$

where a is the distance between axes of the extreme corner piles at the lower part of the module in the direction of the action of the prevailing waves; n is the number of driven corner piles that provide for stability of the support module; and $k_n = 1.4$ is the coefficient of reliability.

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TESTS OF MOBILE UNIT FOR SEALING WELL MOUTH DESCRIBED

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 6, Jun 84 pp 46-50

[Article by B. O. Frenkel', A. V. Krutkin and Yu. I. Pryazhnikov (AzINmash [Azerbaijan Scientific-Research Institute for Petroleum Machinebuilding]): "Tests of Equipment for Sealing the Well Mouth During Geophysical Research and the Perforation of Wells Under Pressure"]

[Text] One of the main tasks for introducing modern progressive technology for completing and sampling wells, which is based upon the drawdown effect during the opening up of a productive formation, is the creation of reliable and safe means for sealing the well mouth.

The difficulty of creating such equipment lies in the necessary to prevent leaks of well fluid that penetrates during operations with a geophysical wire line through capillary passages that are formed by twisting of the wire.

AzINmash has created a system for sealing the well mouth that is based upon the principle of hydrostatic lubrication, wherein a sealing lubricant under a pressure that exceeds the well-mouth pressure is injected into the gap between the guide bushing and the cable.

The results of these operations were realized in a test model of the OUV-80x-350 equipment (figure 1 [not included here]) which was fabricated at the institute's experimental-test base, with the participation of the Plant imeni leyt. Shmidt. The equipment consists of the well-mouth portion and a control station that is mounted on the chassis of a Ural-375D truck. In the transport mode the well-mouth portion also is installed on the truck.

The equipment is intended for sealing well mouths during perforation, blasting and geophysical research during the processes of drilling, well completion and monitoring during the development of oil and gas fields, and for operation in moderate climatic conditions in accordance with GOST [State All-Union Standard] 16350-80 at wells that do not contain corrosive agents.*

As a rule, the well-mouth portion of the equipment is installed during operations at the master Christmas-tree valve, and perforation is performed through

*Modifications of the equipment for use in wells with H_2S and CO_2 contents of up to 6 and 25 percent are to be created.

the tubing (NKT). During well completion, this permits not only the formation to be exposed during drawdown, but also introduction of the wells into operation to be accelerated by excluding the operations of killing the well and stimulating the well after perforation.

Use of the equipment at producing wells provides for the potential, previously lacking, of performing all types of study with wire-line instruments that require monitoring and recording of parameters on the surface.

The well-mouth equipment includes: a seal (hydrostatic and contact) for the wire, lubricator sections, a trap, a preventor, adapters, and roller guides for the wire.

All systems of the equipment are controlled by hydraulics. The scheme for the OUV-80x350 equipment's hydraulic system are shown in figure 2.

The facilities for hydraulic drive and hydraulic control in the equipment are: a pump for feeding the compressed oil, a preventor and a contact seal. The pump is single-piston, double-action with direct drive from the hydraulic cylinder's plungers (the plungers are simultaneously a double-action rod for the pump's hydraulic-drive cylinder).

The pump's reverse is controlled by a hydraulic distributor for directional control. The oil is fed to the pump from the containers under pressure, which comes from the truck's pneumatic system. The pump for the equipment's hydraulic system is driven by the trucks's engine through a power-takeoff box, which is installed on the transmission's distributor box.

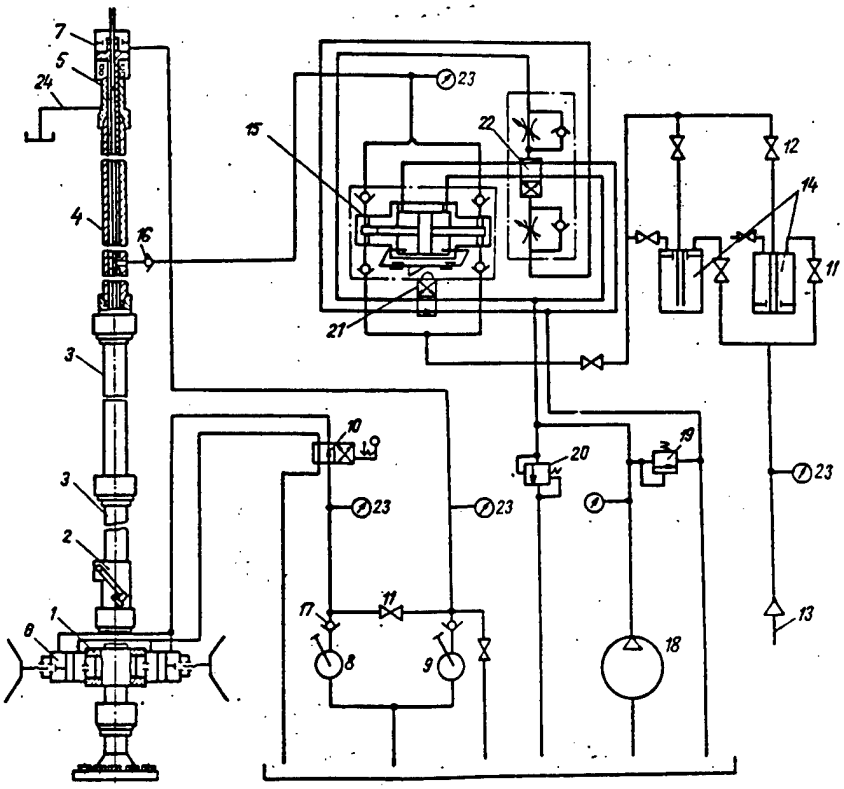
In order to provide for emergency control of the preventor and the contact seal, the working fluid is fed into the cylinders that control these components by manual hydraulic pumps. The oil is fed into the hydrostatic seal through a check valve and is drained through a pipeline into the collecting tank.

Following are the main specifications of the experimental model of the OUV-80x-350 equipment:

Greatest pressure at the well mouth, MPa	35
Diameter, mm:	
Passage for the well-mouth equipment	80
Wire line	6.2-9.4
Greatest feed pressure for the sealing oil, MPa	50
Oil feed, liters/min	0-2.5
Power of the oil-feed pump's hydraulic drive, kW	13.25
Pressure developed by the hydraulic-drive pump, MPa	2.5
Capacity of the oil containers, liters	40
Number of containers	2
Pressure of the hydrostatic head of the oil by the compressed air, MPa, at least	0.5
Control of the preventor and the contact seal, by	GN-200 type manual pumps
Control pressure, MPa	10

Greatest weight of loads for lowering instruments under pressure, kg	160
Dimensions of the complex in the transporting mode, mm	7,600x2,500x3,000
Greatest height of the well-mouth assembly, mm	24,000
Weight, kg:	
Well-mouth assembly	1,580
Assembled complex	11,150

Figure 2.



1. Preventor.
2. Trap.
3. Lubricator section.

4 and 5. Seals, hydrostatic and contact.

6. Hydraulic cylinders for preventor control.
7. Hydraulic control for the contact seal.

8 and 9. Manual hydraulic pumps for control of the preventor.

10. Distributor for controlling the reverse of the preventor's hydraulic cylinders.
11. Valves, hydraulic and air.
12. Valves for oil.
13. Feed lines for the trucks's pneumatic system.
14. Containers for oil.
15. Oil-feed pump.

16 and 17. Respectively, check valve for lubrication and the hydraulic valve.

18. Hydraulic pump.
19. Hydraulic-pump relief valve.
20. Control valve for oil-feed pump pressure.

21 and 22. Hydraulic distributors for controlling the oil-feed pump reverse.

23. Manometers.
24. Oil drain lines.

The experimental model of the equipment was tested in two stages: a preliminary test on a bench-test well at AzINmash, and an acceptance test at producing wells.

During the preliminary tests, the strength of the housing elements of the well-mouth equipment was checked (a hydrostatic pressure test at 70 MPa), as was seal of the well-mouth equipment, together with the sealing members (by hydrostatic pressure testing at 35 MPa).

A check of the operating capabilities of all the equipment's systems and determination of its actual parameters were made during round trips of loads on the 6.2-mm diameter wire line in the bench-test well under a pressure of 20-35 MPa. Total length of cable run was 10,000--of which 4,000 meters were under a pressure of 35 MPa.

Acceptance tests were conducted at injection hole No 44 of the NGDU [Oil and Gas Recovery Administration] of Sal'yanneft', at well No 100, which was being drilled by the Kyursangya UBR [Drilling Administration] of Azneft' [Azerbaijan State Oil Production Association], and production well 284 of the NGDU imeni Marimanov of VPO Kaspmorneftegazprom [All-Union Caspian Offshore Oil and Gas Production Association]. Nine types of geophysical operations, including perforation of three targets, were carried out at the indicated wells.

Operations were performed together with field geophysical parties of the Kura Geophysics Office of Azneftegeofizika [Azerbaijan Oil and Gas Geophysics Trust] and the Gobustan Geophysics Office of Soyuzgazgeofizika [All-Union Geophysics Trust of the Gas Industry].

The flow rate of well No 44 was measured during the injection of water into the formation.

At drilling well No 100, work on perforation of the 3,130-3,160 meter productive interval was planned with an expected drawdown of 20 MPa. Because the well had been an exploration hole, a full cycle of operations was performed on it at first that guaranteed the safety of performing perforation under pressure.

The well-mouth equipment assembly, which is designed for deploying loads that weigh 150 kg, and a PR-54 type jet perforator 6 meters long (total height of the well-mouth assembly was 20.3 meters) were subjected to pressure testing and acceptance monitoring of the operation of all the equipment's systems during the lowering of loads and of a gage on the 9.4 mm wire line into a combination tubing string 114 and 73 mm in diameter, at a pressure of 20 MPa, which was created by 3TsA-400 type pump installations.

Catching occurred in the next descent of the perforator, together with loads, and, as a result of the impermissibility of working PR-54 type perforators up and down in the tubing, the descent was stopped. As an analysis indicated, the catching occurred as a result of incorrect assembly of the loads with the perforators and the forming of kinks in the cable between them.

With a view to perfecting a technology for round trips for perforators, tests were conducted at hole No 284 with collaborators from the Gobustan Geophysics Office of Soyuzgazgeofizika, who had experience in PR-54 type perforator operations.

Well No 284 was stopped for overhaul because of cessation of the flow and conversion to operating in an absorption mode. During the injection of operating fluids into the well, a dynamic equilibrium of pressures in the formation-and-well system was established, with the liquid column 450-500 meters above the collector, at a bottom-hole depth of 3,100 meters. It was planned to

perforate the upper intervals of the productive horizon during the indicated drawdown conditions. A tapered tubing string 3,060 meters long (the upper stage was 114 mm in diameter, its length was 330 meters, and the lower stage diameter was 73 mm) was lowered into the well.

In order to increase precision in determining the depth of the productive zone, a gamma logging with an RKMT-48 logging probe on a wire line 9.4 mm in diameter was first performed. The operations were conducted together with a PK-2 logging lifter and an AKS-L7 laboratory.

The gamma-logging data were: bottom-hole 3,100 meters; productive intervals 3,070-3,073, 3,076-3,079 and 3,086-3089 meters; and level of liquid above the bottom hole 450 meters.

Prior to perforation, monitoring of the operation of all components and systems of the OUV-80x350 equipment was performed. The PR-54 perforator assembly was 3 meter long and was joined with the loads and the wire line through a connecting head. The perforator assembly descended at a speed of 0.3-0.5 meter/-second without complication. Prior to the firing, the preventor and the contact seal were covered, and the oil feed in the hydrostatic seal was set at a pressure of 21 MPa.

The shot was fired and, after a monitoring exposure that lasted 30 minutes, the connecting head and the load were extracted. Similarly, a second lowering of the perforator and a firing were made without complications, after which an influx of fluid began, which bore oil, water, the product from cleaning of the collector, and so on.

The next lowering and firing of the productive interval was accomplished with a preliminary gaging and cleaning of the tubing string's passage.

As a result of the work done, the well was introduced into the operational mode with a flow rate of 10 tons of crude per day.

The indicators and the technical data which define operation of the equipment during the testing process are shown in the table. The averaged values of these indicators are as follows: range of well-head pressures--0-30 MPa; overall length of wire line run under pressure--15,700 meters; working speed of the round trip of the instruments and apparatus--0.3-1.5 meters/second; average oil consumption per 1,000 meters of wire-line run 2-4 liters; and fuel consumption during operation of the station--less than 20 liters per hour.

Round trip operations for assembly and disassembly of the well-head portion of the OUV-80x350 equipment were performed at producing wells by means of Baku-nets-3M and AzINmash-43A type well-repair block-and-tackle installations, and--at wells being drilled--by means of a cathead for the drilling hoist.

The average time for carrying out the preparatory and concluding operations, which are associated with assembly of the well-mouth equipment, connecting it with the control station, and assembly and disassembly at the well mouth, was 7.4 hours.

(A) Вид геофизических работ	(B) Номер скважины	(C) Конструкция подъемной колонны	(D) Глубина спуска инструмента, м	(E) Давление на устье, МПа	(F) Диаметр кабеля, мм	(G) Общий пробег кабеля под давлением, м	(H) Линейная скорость движения кабеля, м/с		(K) Расход смазки, кг	(L) Подготовительно-заключительное время, ч	
							(I) при подъеме	(J) при спуске		(M) на монтаж	(N) на демонтаж
Замер дебита при закачке воды в пласт (спуск-подъем дебитомера) (O)	(R) 44 (НГДУ Сальяннефть)	—	3100	14,0	6,3	8300	1,0	1,4	24	4,25	2,75
Опрессовывание и шаблонирование колонны для спуска перфоратора Перфорация колонны (P)	(S) 100 (Кюрсангинское УБР)	Ø114×73 мм	3170	— (V)	9,4	1700	1,1	0,8	3,5	5,75	2,5
	(T) 284 (НГДУ Нариманов-нефть)	Ø114×73 мм	3086; 3076; 3070	Избыточное до 0,5	9,4	18500	1,4	1,2	30	3,25	3,0
Спуск-подъем груза на каротажном кабеле под давлением (Q)	(U) Стендовая (АзИНмаша)	Ø114 мм	70×85 70×60	18—25 35,0	6,3 9,4	5950 4200	1,5 1,1	1,2 0,8	18 16,5	2,15 —	— —

A. Type of geophysical operation.
B. Well No.
C. Design of the lifting string.
D. Depth of instrument's descent, meters.
E. Pressure at the well mouth, MPa.
F. Cable diameter, mm.
G. Overall cable run under pressure, m.
H. Linear velocity of the cable, m/sec.
I. During descent.
J. During lifting.
K. Oil consumption, kg.
L. Preparatory and concluding time, hr.
M. For assembly.
N. For disassembly.
O. Measurement of flow rate during injection of water into the formation (round trip of the flowmeter).
P. Pressure testing and gaging of the string for descent of the perforator. Perforation of the string.
Q. Round trip of a load on logging wire line under pressure.
R. 44 (NGDU [Oil and Gas Recovery Administration] of Sal'yanneft').
S. 100 (Kursangya UBR [Drilling Administration].
T. 284 (NGDU Narimanovneft').
U. Bench-test well (AzINmash [Azerbaijan Scientific Research Institute for Petroleum Machinebuilding]).
V. Overpressure of less than 0.5

Total time for productive work at wells (not including organizational-type idle time and time for transporting the equipment) was 47 hours. The total distance in moving the installation over highways and field roads, and also over the offshore trestlework route, was 1,520 km.

The experimental model was accepted by an interagency acceptance commission and recommended for series production as a result of the tests that were conducted.

The commission noted the modern level of development, the efficiency of all components and systems, and the correspondence of the design parameters to the actual ones. Simultaneously, it was recommended that a number of improvements be introduced. The most important of them was that of mechanizing the installation in order to reduce the labor intensiveness of assembly and disassembly.

Conclusions

It was determined that the system for sealing the moving wire line, which is of great importance in expanding the methods for geophysical study and perforation of wells under drawdown conditions, including wells that contain corrosive environments, is practically complete.

In order to introduce widely the method of well perforation under pressure through the tubing, organizations and enterprises of the Ministry of Geology, the Ministry of Oil Industry and the Ministry of Gas Industry must take steps to prepare for introduction of the new technology (development of the appropriate directives and methods, the creation of specialized brigades and sections to work with the equipment and service it, expansion of the production of small-size geophysical instruments, and so on).

The equipment for sealing well heads during geophysical operations under pressure is one of the complicated types of oilfield equipment whose characteristic indicators should be the degree of operating reliability and safety for performing the work.

In order to realize the indicated indicators, specialized production of the equipment by the system of petroleum-machinebuilding enterprises must be organized.

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RESERVES FOR IMPROVING REPAIR WORK AT OIL, GAS FIELDS NAMED

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[Article by S. G. Agayev, N. Kh. Atayan, K. G. Sadykhov (AzINEFTEKhIM [Azerbaijan Petrochemical Scientific-Research Institute] imeni M. Azizbekov) and Z. G. Ashurov (Institute of Economics, Azerbaijan SSR Academy of Sciences): "An Analysis of the Technical and Economics Indicators for Repairing Oilfield Equipment"]

[Text] In an era of intensifying oil and gas recovery operations in every possible way, questions of increasing the effectiveness of repairing oilfield equipment are of special importance. These problems can be solved by making analyses that can find actual production reserves, on the basis of which feasibility is determined.

The target of this analysis were the NGDU's [Oil and Gas Recovery Administration] of Leninneft', Ordzhonikidzeneft', imeni 26 Bakinskiye Komissary, Karadagneft', Kirovneft' and Azizbekovneft' of the p/o Azneft' [Azerbaijan State Oil Production Administration]. This article uses accounting and reporting data of the NGDU's being examined for the years 1980 and 1981.

We have examined the overall technical and economic characteristics of the repair services. This encompassed a study of the amount of oilfield equipment repair and the labor expenditures and prime operating costs of the repair work.

Analysis of the amount of oilfield equipment repair consisted in finding the correspondence of the services extended to the particular needs of NGDU operations, a determination of the level of centralization and specialization of equipment repair within the NGDU, and an examination of the structure and quality of the repairs.

In order to analyze the correspondence of the services extended to the particular operating needs of the NGDU, the nature of these services was studied by category. The amount of spare parts, metalware, metal constructional structure and nonstandard equipment and special tools was examined.

Special attention was paid to the overhaul of oilfield equipment.

The analysis determined that, for the NGDU's examined, the main share of services were for overhaul of the equipment. However, while in the NGDU's of Karadagneft' and imeni 26 Bakinskiye Komissary the specific shares of overhaul were, respectively, 96.4 and 97.9 percent, in the NGDU of Kirovneft' it was only 28.1 percent. Equipment in the NGDU of Azizbekovneft' was not overhauled.

Basically, the NGDU's surveyed fabricated spare parts, but this, however, was a small portion (1.5-28 percent). It was noted that, while in the NGDU of Azizneftbekovneft' the amount of services consisted of only about 415,000 rubles' worth, in the NGDU of Ordzhonikidzeneft' it was 1,912,000 rubles' worth.

An analysis of the place where work orders are executed indicated that, for all the NGDU's examined, repair basically was being accomplished by in-house forces, and an insignificant amount of it was being done at plants of p/o Azneft' and outside ministries. This resulted primarily from lack of the potential for full placement of work orders at specialized plants, and also from inadequate cost-accounting incentives for outside enterprises to execute the many types of repair.

Thus, the NGDU of Leninneft' did 57.6 percent of its own equipment repair, the NGDU of Azizbekovneft' did 89.7 percent, Kirovneft' 46.1 percent, Karadagneft' 56.5 percent, imeni 26 Bakinskiye Komissary 69.5 percent, and Ordzhonikidzeneft' 63.4 percent.

It should be noted that mechanical equipment constituted the main share in the structure of equipment repaired. Thus, in the NGDU of Azizbekovneft' the share of mechanical equipment repaired was 99.7 percent, Leninneft' 54.8 percent and Kirovneft' 50.6 percent. At the same time, in the NGDU's of Karadagneft' and Ordzhonikidzeneft' the structure of repair presented a different picture. Here, mainly power equipment was being repaired, 71.4 and 71.9 percent respectively. Analysis of the situation found indicated a substantial differentiation in the capacity of the NGDU's repair bases where there were corresponding conditions of repair diversity, and a low level of specialization and centralization of repair.

The main types of equipment that were subject to repair were pumping jacks, operating masts, reduction gear and compressors. Power-engineering equipment that required repair consisted of electric motors and transformers.

An analysis of the dynamics of the amount of oilfield-equipment repair in 1981 relative to 1980 showed for the NGDU of Leninneft' an increase by 339 units, for Karadagneft' 309 and for Ordzhonikidzeneft' 110 units, while there was a reduction in the amounts of repair of 5 units for the NGDU of Azizbekovneft' and of 129 units for the NGDU imeni 26 Bakinskiye Komissary. However, the planning schedules called for a reduction in repair volume for the NGDU's of Leninneft' and Karadagneft' and an increase for the NGDU of Azizbekovneft'. The substantial reduction in repair volume in the planning schedule for 1981 (55 units altogether) in the NGDU of Kirovneft', when the actual amount thereof in 1980 was 1,406 units, demands attention. This indicates low quality of preparation of the planning schedules, which do not adequately consider the actual conditions and methods for engineering substantiation for the plan period. A deeper analysis indicated that the amount of repair increased mainly for mechanical equipment, although an increase in power-equipment repair was also noted.

The determination and analysis of labor expenditures for performing repairs are of great importance in assessing efficiency in organizing repair in the NGDU's. At the oil and gas producing enterprises surveyed, an accurate breakdown of personnel engaged in repair and operational servicing was lacking, and this fact caused a certain arbitrariness in relating them to one group or another.

The analysis of labor expenditures for repairing oilfield equipment was supported by an examination of the personnel manning of the NGDU's that perform the repair function and of the quantitative and trades composition of the repair workers and by a study of promotions and transfers of the repair worker force. A study of the composition and structure of the wage fund, the use of repair-worker worktime, and the structure of the workers' workday had an important place.

An analysis of worker manning of NGDU's to which repair functions had been delegated indicated that, as a whole, they occupy a small share at all the enterprises surveyed, comprising about 5.7-12 percent of total personnel manning. Of all repair workers, about 1.0-3.5 percent are engaged in overhaul. Mechanics are the most numerous in the trades makeup of repair personnel at oil and gas recovery enterprises: from 36 people at the NGDU of Azizbekovneft' to 117 people at the NGDU of Ordzhonikidzeneft'. Their qualifications were approximately equal in all the enterprises studied, as determined by the average specialists' ranking of 3.7-4.0.

The analysis found an adequately stable and high level of average ratings (4.5) for repair workers of the main trades (lathe operator and electrical and gas welders). At the same time, drill operators, winders, thread cutters and others do not possess skill levels high enough, judging by the average skill category of No 2.

Thus, an analysis of the quantities and the trades composition of repair personnel found throughout all the NGDU's a large differentiation in both specialists and manning for workers who are engaged in repairing oilfield equipment.

Substantial turnover by reason of retirement was observed in the work force engaged in repair. At the NGDU of Leninneft' it was 45.5 percent, of Karadagneft' 24.7 percent, of Azizbekovneft' 16.4 percent, of Kirovneft' 14.3 percent, of imeni 26 Bakinskiye Komissary 9.0 percent, and of Ordzhonikidzeneft' 6.7 percent.

A great excess of retirements of workers over arrivals was noted. While it increased by 4.9 points at the NGDU of Azizbekovneft', it was 14.1 points in the NGDU of Leninneft'

The regular reporting of the NGDU's on labor lacked data about the composition and structure of the repair workers' wage fund. However, for purposes of making a deep analysis of NGDU reporting, the composition of the repair workers' wage fund for specialized NGDU departments (PRTsEO and PRTsEE) and for workers engaged in repair in nonspecialized departments (2 departments each at each NGDU), where basically the greatest amount of repair work was concentrated, were found. It was noted that the basic form of wage is time payment, which was 48 percent in the NGDU of Leninneft' and 63.7 percent in the NGDU of Azizbekovneft'. A small number of workers were being paid at piece-work rates.

An inadequate level of organization of the repair workers' labor was found. A system of norms and standards for repair and pay for piece-work was lacking, yet there was a wide range of repair operations.

An analysis of the use of repair worker time found that absences from work came to 1,784 mandays (6.7 percent of the total number) in the NGDU Azizbekovneft' against 6,730 mandays for the NGDU of Ordzhonikidzeneft'. Adjusted figures indicate the need to strengthen work in the area of work safety.

The problem of determining actual worktime losses due to idle time is controversial. However, in order to define this reserve, it is preferable to be guided by achievements both in the USSR and abroad that are large scale and conclusive.

Along with an increase in the shiftwork factor of the equipment, a reserve for increasing repair-work effectiveness is a rise in the strenuousness of the work of servicing personnel. It was noted, from the results of photography of the workday of some PRTsEO workers of the oil-and-gas recovery enterprises that were surveyed, that the greatest idle time for equipment is caused by the absence of workers who have been diverted to the performance of work that is not connected with operation of the equipment assigned to him. Moreover, time lost because of the lack of instructions by the department's supervisor is still great.

An analysis of labor expenditures as a whole indicated that one of the important reserves for increasing efficiency of the repair workers' labor is that of regulation of the composition of their wage fund. A reduction in overtime work and of all-day and within-shift idle time will enable the content of the wage fund and its structure to be raised. Standardized tasks for hourly workers, and also bonus-award rules that are linked as closely as possible to the contribution of each repairman to achievement of the final product, should play a definite role in regulating the content of the wage fund.

An analysis of expenditures for oilfield-equipment repair was provided by examining the areas of the expenditures of funds by element of expense during 1981 of the oil-and-gas recovery enterprises surveyed. Expenditures for equipment repair varied over a great range--from 221,300 rubles in the NGDU of Kirovneft' to 1,268,200 rubles in the NGDU of Ordzhonikidze. A reduction in repair expenditures in 1981 from 1980's is noted. Throughout all the enterprises surveyed, the greatest share of the expenditures in overall expenses for repair was the basic and additional wage. This means that this factor must be regulated more actively in order to provide for an increase in the efficiency of repair work. For the enterprises surveyed as a whole, the share of expenditures for repair within overall expenditures for the upkeep and operation of equipment varied over a broad range in 1981--from 28.1 percent in the NGDU of Ordzhonikidzeneft' to 1.4 percent in the NGDU imeni 26 Bakinskiye Komissary. It was discovered that the composition, quantity and age structure of the machine tools and mechanisms used in repairing oilfield equipment, as reflected in writeoff, govern a small share in the total equipment amortization at the enterprises surveyed, that is, from 0.3 percent in the NGDU imeni 26 Bakinskiye Komissary to 5.6 percent in the NGDU of Leninneft'. This, however, is coupled with the relatively high share of expenditures for material means

(working capital) that is earmarked for repairs in the NGDU's overall working capital. Thus, in the NGDU imeni 26 Bakinskiye Komissary this share was 4.9 percent versus 12.4 percent in the NGDU's of Azizbekovneft' and Ordzhonikidzeneft'. The indicated divergence is a result of substantial differences at the surveyed enterprises in the complexity of the repairs, their materials intensiveness and an accurate procedure for setting norms for their consumption. A substantial excess was found throughout all NGDU's in expenditures for equipment overhaul in comparison with amortization for equipment overhaul, which is a basic source of financing the indicated expenditures. This necessitates an additional mobilization of resources for capital repair, which, however, is not an easy task for the "old" NGDU's. One of the reserves here is reduction of expenditures for equipment overhaul by raising the level of specialization and concentration of repair work.

Conclusions

The repair-operations' services that are being extended vary greatly in terms of the range of services performed and they do not correspond adequately with the particulars of NGDU operations.

The repair operations of the surveyed enterprises are marked by a low level of centralization and specialization, which results from the existing regional siting of repair bases and the dispersion thereof, and also inadequate consideration of the potential and the capacity of specialized repair enterprises for the timely accommodation of NGDU orders.

Repair operations are being planned without adequate consideration of the actual conditions and methods for engineering control.

Purposeful accounting and reporting which characterize sufficiently the economic activity of repair operations were lacking at the enterprises surveyed.

The analysis of labor expenditures found substantial reserves for the quantitative and vocational makeup of repair workers, the wage structure and the use of worktime.

Optimal specialization of the NGDU's repair services and an economically justified siting of repair bases should be considered the main reserves for increasing the repair operation's effectiveness.

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THERMODYNAMICS PINPOINT POSSIBLE OIL FIELD LOCATIONS

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[Article by F. M. Gadzhiyev, R. G. Abilov, E. D. Khalilov, AzNIPIneft' (not further identified): "Some Thermodynamic Features of Mesozoic-Cenozoic Deposits of the Iori-Adzhinour Petroleum and Gas Bearing Region"]

[Text] Investigation of reservoir pressures of water bearing complexes has important significance to determining the basic directions of movement of fluids and to establishing the zones of the greatest heads and discharges.

Available reservoir pressure data can be used as a basis for a tentative hydrodynamic description of the basin's Mesozoic-Cenozoic deposits. Table 1 gives the absolute elevation of the piezometric water head to permit comparison of the measured reservoir pressures of wells tapping individual water pressure systems.

The reservoir pressures of the Mesozoic-Cenozoic water pressure complex were studied at the Shuagara (wells No 1,2), Teleti and Il'dokani areas. The data in Table 1 show that within the limits of certain areas of eastern Georgia, in the zone of extensive exposure of Mesozoic deposits on the earth's surface, reservoir pressures increase from 16.4 to 49.4 MPa (the Shuagara area) as the depth of occurrence of the tested water bearing formations increases. However, depending on the location of individual areas within the limits of the petroleum and gas bearing basin, on the degree of exposure of the given structure, on the lithofacial features of the surrounding deposits and so on, this law breaks down. Thus for example the absolute elevation of the corrected piezometric water head in Upper Cretaceous deposits in the Teleti area (well No 11), which were tapped at a depth of 3,141-2,715 m, is much lower (+79 m) than in the Shuagara area (well No 1, +3,126 m), where Upper Cretaceous deposits occur at a depth of 2,645-2,635 m. This can be explained by the fact that at the location of the Teleti area, Cretaceous deposits are more exposed and they have a close relationship with atmospheric water on the surface. Evidence of this can also be found in mineralization and the chemical composition of reservoir waters of Cretaceous deposits within the confines of the Teleti area (Σ_{a+K}=0,72 mg-equiv) and the Shuagara area (Σ_{a+K}=22-23.5 mg-equiv).

In Paleocene-Eocene deposits a rise in reservoir pressure is observed with depth of occurrence of water bearing formations. It varies from 6.3 MPa in

Table 1

Месторождение, площадь (1)	Номер скважины (2)	Интервал перфорации, м (3)	Геологический возраст (4)	Пластовое давление, МПа (5)	Абсолютная высота приведенного пьезометрического напора воды, м (6)
(7) Патара-Шираки	83	1184—916	Верхний отдел ширакской свиты (25)	4,8	69
(8) То же	79	2065—2034	То же	32,2	1808
(9) Тюлькитапа	1	—	Верхний сармат (26) (морская фация)	—	203
(10) Гайда	4	1050—1012	То же	18,5	1135
(11) Иори	8	1462—1455	Верхний сармат (эльдарская свита) (27)	22,5	1138
(10) Гайда	3	1997—1984	Средний сармат (28)	35,4	1879
(12) Тарибани	23	2302—2290	Верхний сармат (эльдарская свита) (27)	43,1	2488
(13) Кила-Купра	7	2346*	Верхний сармат (26) (морская фация)	43,4	2465
(12) Тарибани	33	2314—2284	Верхний сармат (эльдарская свита) (27)	46,6	2864
(14) Уджарма	16	2219—2119	Средний миоцен (29)	32,7	1971
То же	16	2214—2105	То же	48,0	2612
(15) Сацхениси	3	1015—955	Майкопская свита (30)	5,0	676,4
То же	1	1046—1099	То же	7,6	693
"	8	1932—1988	"	16,5	735
"	31	2383—2446	Верхний эоцен (31)	19,9	397
(16) Самгори	7	2656,5*	Средний эоцен (32)	23,5	459
То же	7	2620—2690	То же	23,7	461
"	3	3120—3118	"	28,5	452
"	3	3294—3205	"	29,7	478
(17) Лаки	1	2600*	"	26,7	782
(18) Телети	4	665*	"	6,3	417
(19) Рустави	1	2122—2093	"	15,3	77,8
(20) Варкетили	6	—	"	—	411
(21) Тбилиси	5	137,4—867	"	—	404,3
То же	2	309—1135	"	—	424,6
"	7	1470—1485	Нижний эоцен (33)	—	429,15
(18) Телети	12	2860—2960	Палеоцен (34)	—	409,8
(22) Табори	3	4118—3858	Палеоцен—нижний эоцен (35)	16,5	77,8
То же	2	1639—1562	Верхний мел (36)	16,4	521
(23) Шуагара	2	1771—1750	То же	19,4	682
То же	2	1950—1925	"	—	795,6
"	1	2646—2635	"	49,4	3126
(18) Телети	11	3141—2715	"	33,0	79
(24) Ельдокани	45	905—891	Нижний мел (37)	10,0	1588

*Depth of well bottom, m.

Key:

1. Deposit, area
2. Well number
3. Perforation interval
4. Geological age
5. Reservoir pressure, MPa
6. Absolute elevation of corrected piezometric water head, m
7. Patara-Shiraki
8. As above
9. Tyul'kitapa
10. Bayda
11. Iori
12. Taribani
13. Kila-Kupra
14. Udzharma
15. Satskhenisi
16. Samgori
17. Laki
18. Teleti

[Continued on following page]

19. Rustavi
20. Varketili
21. Tbilisi
22. Tabori
23. Shuagara
24. Yel'dokani
25. Upper series, Shiraki Suite
26. Upper Sarmat (marine facies)
27. Upper Sarmat (El'dar suite)
28. Middle Sarmat
29. Middle Miocene
30. Maykop Suite
31. Upper Eocene
32. Middle Eocene
33. Lower Eocene
34. Paleocene
35. Paleocene-Lower Eocene
36. Upper Cretaceous
37. Lower Cretaceous

the Teleti area to 29.7 MPa in the Samgori area. Investigation of reservoir pressures in the Satskhenisi (Maykop Suite), Udzharma (Middle Miocene), Tyul'kitapa, Bayda, Iori, Taribani, Kila-Kupra (Sarmat stage) and Patara-Shiraki (Shiraki series) areas showed that the nature of their change in cross section basically follows the law noted above.

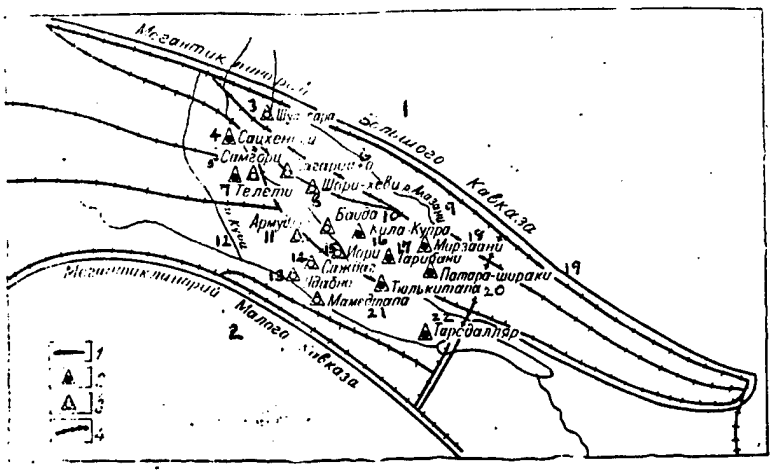
Were we to turn our attention to the location of the structures within the confines of which reservoir pressures of the Sarmat water bearing complex were studied (see figure), we could assert that the lowest absolute elevation of the corrected piezometric head of reservoir waters is noted in the Tyul'kitapa area (+253 m)--that is, in the Chatminskaya uplifted zone, where Neogene-Quaternary structures are uplifted, exposed, partially eroded and severely dislocated. As we move northward from this zone, in the direction of the central part of the Yuzhnokakhetinskaya depression, where the Sarmat water bearing complex descends into the interior, the absolute elevation of the corrected piezometric head of reservoir waters rises to +2,488 m.

The discussion above demonstrates that movement of reservoir waters of the Sarmat water pressure complex proceeds, as should have been expected, from deeper zones of the depression to zones higher up and dislocated, serving as relief zones for reservoir waters.

A geothermal investigation of minor proportions was conducted in the Iori-Adzhinour petroleum and gas bearing basin at the Sazhdag, Armudly, Damirtapa-Udabno, Mamedtapa and Samgori areas.

Analysis of the geothermal data shows (Table 2) that the geothermal conditions of individual zones in areas of the Iori-Adzhinour petroleum and gas bearing basin differ significantly. High temperatures are typical of areas located within the confines of the eastern submergence of the Adzharo-Trialetskaya folded zone (Samgori and others). Thus in the Samgori area reservoir temperature at a depth of 2,500 m attains 143°C; in this case the geothermal step increases from 19.3 m/°C at sea level to 41.7 m/°C at a depth of 2,500 m, and the geothermal gradient decreases correspondingly from 5.2 to 2.4 °C/100 m.

In comparison with this zone, the central part of the region between the Kura and Iori rivers (Sazhdag, Armudly, Damirtapa-Udabno, Mamedtapa) is characterized by relatively low temperatures. The lowest temperature was noted at the



Schematic review map of the Iori-Adzhinour petroleum and gas bearing region: *1*--region boundary; *2*--petroleum deposits; *3*--explored areas for which thermodynamic data are available; *4*--large fractures

Key:

1. Mesoanticlinorium of the Greater Caucasus
2. Mesoanticlinorium of the Lesser Caucasus
3. Shua-gara
4. Satskhenisi
5. Samgori
6. Sagaredzho
7. Teleti
8. Shori-khevi
9. Alazani River
10. Bayda
11. Armudly
12. Kura River
13. Udabno
14. Sazhdag
15. Iori
16. Kila-Kupra
17. Taribani
18. Mirzaani
19. Patara-Shiraki
20. Tyul'kitapa
21. Mamedtapa
22. Tarsdallyar

Sazhdag, Armudly and Damirtapa-Udabno areas, varying from 17-24.7°C at sea level to 78.8-83.3°C at a depth of 2,500 m. In this case the geothermal step increases from top down along the cross section from 18.6-26.3 m/°C at sea level to 27-54 m/°C at a depth of 2,500 m.

Among the investigated areas in the region between the Kura and Iori rivers, the Mamedtapa area, which is located south of the above-indicated structures, is distinguished by higher temperature conditions. In this area the reservoir temperature increases from 15°C at sea level to 93.3°C at a depth of 2,500 m. In this case the geothermal step increases from 23.3 to 66.1 m/°C, while the geothermal gradient decreases from 4.3 to 1.5°C/100 m.

Comparison of the geothermal characteristics of the investigated areas with the geological conditions of their occurrence would show that the thinner the sedimentary formation, the higher is the reservoir temperature. For example

Table 2

Абсолютная глубина, м (11)	(1) Междуречье Куры и Иори												(2) Восточная Грузия		
	Саждаг, скв. 1 (3)			Армудлы, скв. 2 (4)			Дамиртапа—Удабно, скв. 1 (5)			Мамедтапа, скв. 1 (6)			Самгори, скв. 2 (7)		
	Температура, °С (8)	Геотермическая ступень, м/°С (9)	Геотермический градиент, °С/100 м (10)	Температура, °С	Геотермическая ступень, м/°С	Геотермический градиент, °С/100 м	Температура, °С	Геотермическая ступень, м/°С	Геотермический градиент, °С/100 м	Температура, °С	Геотермическая ступень, м/°С	Геотермический градиент, °С/100 м	Температура, °С	Геотермическая ступень, м/°С	Геотермический градиент, °С/100 м
+100	13,2	26,3	3,8	20,0	23,4	4,27	17,3	18,6	5,3	10,7	23,2	4,3	40,7	22,7	4,4
0	17,0	26,3	3,8	24,7	23,4	4,27	22,4	18,6	5,3	15,0	23,2	4,3	46,7	19,3	5,2
—500	36,0	26,3	3,6	36,7	67,8	1,50	36,1	51,5	1,9	36,6	23,2	4,3	69,0	20,8	4,8
—1000	55,0	26,3	3,8	46,4	43,3	2,3	43,6	51,5	1,9	49,6	52,7	1,9	91,0	24,0	4,1
—1500	64,8	31,0	3,2	58,2	40,0	2,5	61,6	51,5	1,9	63,5	40,0	2,5	114,2	22,2	4,5
—2000	69,5	53,5	1,8	70,7	36,2	2,7	74,4	34,0	2,64	83,6	28,5	3,5	131,4	47,6	2,1
—2500	78,8	53,5	1,8	86,7	27,0	3,7	87,3	54,0	1,8	93,3	66,1	1,5	143,4	41,7	2,4
—3000	88,0	53,5	1,8	98,8	31,6	3,1	97,0	50,6	2,0	101,0	66,1	1,5	—	—	—
—3500	97,5	53,5	1,8	111,0	68,0	1,5	107,5	147,0	0,7	—	—	—	—	—	—
—4000	—	—	—	122,6	31,0	3,3	111,0	148,0	0,7	—	—	—	—	—	—
—4500	—	—	—	138,7	31,0	3,1	—	—	—	—	—	—	—	—	—

Key:

1. Region between Kura and Iori rivers
2. Eastern Georgia
3. Sazhdag, well No 1
4. Armudly, well No 2
5. Damirtapa-Udabno, well No 1
6. Mamedtapa, well No 1
7. Samgori, well No 2
8. Temperature, °C
9. Geothermal step, m/°C
10. Geothermal gradient, °C/100 m
11. Absolute depth, m

at sea level in the Samgori area, where the thickness of the sedimentary formation does not exceed 5-6 km, reservoir temperature is 45.7°C; in the Sazhdag, Armudly, Damirtapa-Udabno and Mamedtapa areas, where the thickness of the sedimentary series exceeds 7-8 km, the temperature varies from 17 to 24.7°C. At deeper levels this law manifests itself even more graphically. Thus at an absolute elevation of 2,500 m, reservoir temperatures are 143.4°C for the Samgori area, 78.8°C for the Sazhdag area, 86.7°C for the Armudly area, 87.3°C for the Damirtapa-Udabno area and 93.3°C for the Mamedtapa area.

The law of change in temperature with depth of occurrence of the crystalline basement established here for Azerbaijan was noted in a publication authored by Sh. F. Mekhtiyev, A. A. Geodekyan, A. B. Tsaturyants, Zh. N. Ter-Karapetyants, E. M. Bayramov and S. F. Shabanov.*

It should be noted that the higher temperatures of the Mamedtapa area (among the areas that were investigated in the region between the Kura and Iori rivers) tie in well with the decrease in thickness of the sedimentary formation within its confines and with its closeness to a deep-seated fault. There can be no doubt that deep-seated faults can be the cause of temperature anomalies if heat is carried along their plane.

Numerous natural oil, gas and water seepages noted within the confines of the Iori-Adzhinour trough and the recent discovery of a new oil field in the Tarsdallyar area associated with Eocene deposits indicate that the thermodynamic conditions of Mesozoic-Cenozoic deposits in the trough are extremely favorable to accumulation of hydrocarbon reservoirs.

In our opinion the following areas are of considerable interest in terms of finding new petroleum and gas deposits: Keyryuk-Keylan, Western Palantekyan, Eastern Palantekyan, Tyul'kitapa and others located in a zone characterized by favorable thermodynamic conditions.

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*Mekhtiyev, Sh. F., Geodekyan, A. A., Tsaturyants, A. B. et al., "Geotermiya neftegazonosnykh oblastey Azerbaydzhana i Turkmenii" [Geothermal Characteristics of Petroleum and Gas Bearing Regions of Azerbaijan and Turkmenistan], Moscow, Nauka, 1973, 191 pp.

UDC 622.276.5.001.5(575.4)

ADDED YIELD FROM DEPLETED GAS-CONDENSATE DEPOSIT POSSIBLE

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 84 pp 11-13

[Article by M. A. Mirdzhafarov and V. G. Sarkisov, VNIPIgaz (not further identified): "Status of a Depleted Gas Condensate Deposit with an Oil Fringe"]

[Text] Development of gas-condensate deposits with an oil fringe by natural depletion drive does not permit attainment of high coefficients of condensate and oil output. Nor is a horizon VII reservoir an exception. By the end of development here, the coefficients of condensate and oil output were 0.4 and 0.1 respectively.

During an examination of the question of extracting the residual condensate, the possibility of extracting it incidentally in the course of gas extraction was noted, and the quantity that would be extracted in each cycle was computed. But the assessment of residual reserves did not account for a number of factors, and it was assumed that residual condensate is concentrated in the current gas bearing zone. However, it is known that the size of retrograde losses depends basically on the rate of decline of reservoir pressure and on the initial concentration of condensate in gas phase [1,2].

Because the initial concentration of condensate varied significantly along the reservoir, the distribution of settling condensate was also found to be irregular. It should also be noted in this case that development of the gas zone was accompanied by intrusion of an oil fringe into its limits, and that a sizable fraction of the liquid phase ended up in the zone that was subsequently occupied by oil.

The issue of determining more accurately the residual condensate reserves and their distribution over the area of the deposit is acquiring important significance in connection with development of measures to increase extraction of retrograde condensate.

A map of equal values of initial condensate concentration in gas phase was plotted and the dynamics of condensate yield in the course of the deposit's development in the presence of change in the volume parameters of the gas and oil zones were analyzed with this purpose on the basis of gas field data.

Figure 1 shows the distribution of the initial condensate concentrations in the gas-condensate zone of the deposit, which varied from 0.22 to 0.14 kg/m^3,

averaging 0.18 kg/m^3 for the bed. The maximum initial concentration is in the southeastern part of the bed. The gas-condensate factor and the density and yield of condensate gradually decrease as we ascend up the bed toward the northwest and west. The thickness of horizon VII gradually decreases in approximately the same direction; its reservoir properties worsen, and the clay content and the concentration of bound water in pores rise.

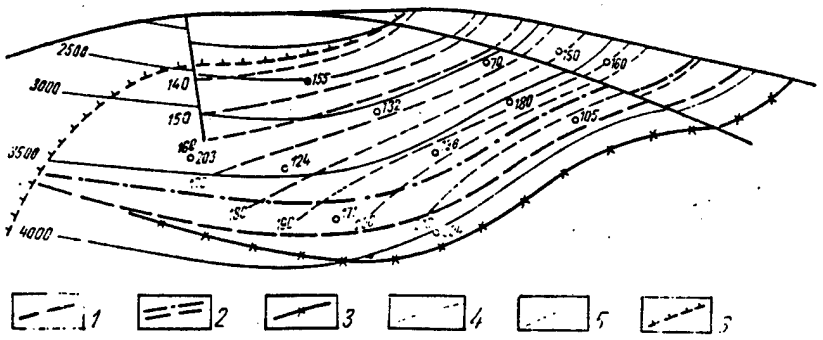

Figure 1. *1*--tectonic ruptures; *2*--current and initial gas-oil outline; *3*--initial water boundary; *4*--horizon VII roof contours; *5*--lines of equal condensate concentration; *6*--line of wedging-out of productive reservoirs

It should be noted that if change in the lithological and physical parameters of the bed is a product of the physical geographical situation and the paleotectonic conditions of sediment accumulation, then concentric arrangement of the isolines of the initial concentration of condensate in gas in relation to the oil fringe indicates a certain genetic mutual relationship between the latter. Thus the oil fringe, which narrows sharply toward the west, loses its commercial significance; the initial concentration of condensate in gas also decreases in the same direction irrespective of the initial hydrostatic pressures in the bed.

According to the initial values of condensate concentration, the greatest condensate losses occurred in the southeastern portion of the reservoir, and especially near the oil fringe.

Settling of condensate from gas began back before invasion of the oil fringe into the gas-condensate zone, practically at the very beginning of development. The pressure of initial condensation of the bed's gas-condensate mixture was 39 MPa, while the pressure of maximum condensation was 7 MPa.

In the initial stage of development of the gas-condensate zone, when pressure in the reservoir dropped from 39 to 28 MPa, retrograde losses were relatively small, and the condensate yield decreased from 0.18 to 0.14 kg/m^3 (Figure 2).

Thus a 1 MPa pressure drop was accompanied by a 0.004 kg/m^3 decrease in condensate yield. When pressure dropped to 10 MPa, the concentration of condensate in gas fell to 0.035 kg/m^3--that is, a 1 MPa pressure drop was accompanied by a 0.006 kg/m^3 decrease in yield. Noticeable decline of the rate of retrograde losses and relative stabilization of the condensate yield resulting from normal evaporation were observed subsequently. The period in which reservoir pressure declined from 30 to 10 MPa was characterized by the principal condensate losses (up to 80 percent).

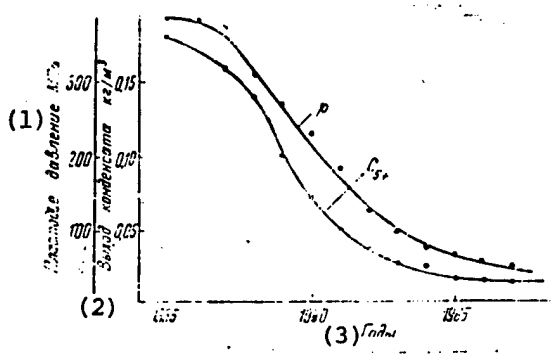

Figure 2. Change in Reservoir Pressure and Condensate Yield C_{5+} in the Course of the Deposit's Development

Key:
1. Reservoir pressure, MPa
2. Condensate yield, kg/m^3
3. Year

Despite rapid depletion of the gas-condensate zone and the resulting appearance of a pressure difference (of up to 15 MPa) between the oil and gas zones, oil appeared in gas condensate well No 105, located near the gas-oil outline at the moment when reservoir pressure was 9.5 MPa--that is, after the bulk of the condensate had already been lost. After this the rate of advance of the gas-oil outline increased somewhat. It subsequently moved upward in the bed to 230 m, occupying about 30 percent of the initial volume of the gas zone. The height of the oil fringe increased from 180 to 300 m, while the volume of pores occupied by oil increased from 22 to 34 million m^3. The high rate of invasion of the oil fringe into the gas zone was the product of the potential energy of occluded gas and deformation of the bed in response to preferential development of the gas-condensate zone, as well as the presence of condensate settling within the bed.

In the course of development, part of the initial condensate reserves settled into this zone; mixing with the invading oil, it caused a decrease in its density, viscosity and tar content, and promoted a high rate of invasion by the oil fringe. As a result the quantity of liquid hydrocarbons in the oil zone increased to practically its initial value.

However, despite the sufficiently high reservoir pressure in the zone of the oil fringe (an average of 20 MPa), oil extraction presented certain difficulties. The main reasons for this were: the low productivity of oil wells with high

gas factors (4,000-6,000 m^3/m^3), flooding, the considerable depth of the reservoir (over 3,700 m), inadequate technical possibilities and so on, in connection with which development of the deposit was halted.

The pressure in the oil zone is presently growing, though slowly (by an average of 0.3 MPa per year), which is apparently connected with the weak head of marginal waters. Reservoir pressure beyond the perimeter is 35 MPa at a depth of 4,100 m.

The rather high gas factors atypical of an oil reservoir suggest the presence, in oil in dissolved state, of a significant quantity of gas of the initial composition, containing a certain quantity of liquid hydrocarbons at the pressures indicated for the reservoir. This is evidenced by the decrease in density, viscosity and tar content of degassed oil occurring in the course of the deposit's development [3].

Thus, knowing the distribution of the residual reserves of condensate in the deposit, we can plan the most sensible well distribution variant and procedures for operating these wells with the goal of adjusting the rate of gas removal and reducing the time it takes to extract the residual condensate, and to select the measures for intensifying condensate extraction.

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WELL DRILLING STRATEGY PROPOSED FOR TARSDALLYAR AREA

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 84 pp 16-21

[Article by M. K. Seid-Rza, A. D. Abdullayev, N. N. Yadullayev, S. A. Muradyan and N. A. Gadzhiyev, AzNIPIneft' (not further identified): "The Question of Drilling Wells in the Tarsdallyar Area"]

[Text] Deposits of the Eocene-Mesozoic complex are believed to be the most promising in terms of oil and gas in the region between the Kura and Iori rivers. The first well drilled into the Upper Eocene deposit of the Tarsdallyar area within this region revealed a commercially feasible oil reservoir. Plans have been made to significantly expand drilling operations in order to illuminate the details of the structural features of the complex, to study the tectonics and the occurrence of oil and gas in these deposits and to determine the perimeter of the reservoir.

Drilling the first deep exploratory wells in areas in the region between the Kura and Iori rivers was accompanied by significant complications due to certain inaccuracies in data characterizing the tectonics of the structure, the reservoir and pore pressures and the temperature regime of rock encountered along the way, the intervals of occurrence of individual stratigraphic formations and possible complications that could be encountered along the way; this noticeably reduced the well drilling rate.

Because of this situation these problems were meticulously analyzed and pinpointed in the course of drilling the first wells in order to obtain scientifically grounded raw data with which to plan subsequent wells and insure their successful drilling at the best technical-economic indicators.

This work was carried out in the Sazhdag (wells No 1,2,3,4, and 5), Damirtapa-Udabno (wells No 1,2 and 3), Gyurzundag (wells No 1 and 3), Keyryuk-Keylan (well No 1) and Tarsdallyar (well No 1) areas.

Areas of abnormally high reservoir pressure (AHRP), the pore and reservoir pressure gradients and other data were revealed using the procedure described in [1] during drilling of these wells.

The results of research and analysis of the oil field material served as a basis for plotting summary maps for the Sazhdag, Damirtapa-Udabno and Gyurzundag areas. These maps reflect the geological drilling conditions, the

typical complications associated with individual stratigraphic formations and their intensity, the distribution of pore and reservoir pressure gradients with respect to depth, changes in density of clayey rock and so on (figures 1-3).

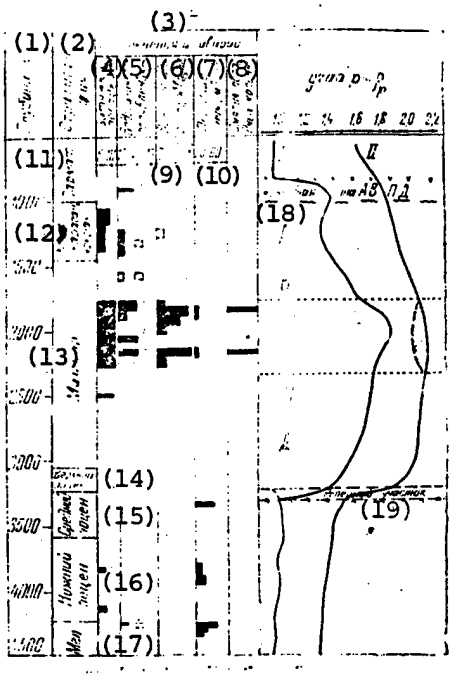

Figure 1. Sazhdag Area: *1*--blocks of mud interrupted by gas during flushing following round trip operations; *2*--gas seepages; *3*--zone of fluid clay with AHRP; I--reservoir pore pressure gradient; II--rock hydraulic fracturing gradient. (This legend applies to figures 2,3,4 as well.)

Key:

1. Depth
2. Stratigraphy
3. Complications and failures
4. Drag, jamming
5. Water, gas and oil seepages
6. Rock lifting, cave-ins, collapses
7. Circulation losses, m^3
8. Collapse of casing string
9. Weak
10. Intensive
11. Sarmat
12. Konk-Karagan, Chokrak
13. Maykop
14. Upper Eocene
15. Middle Eocene
16. Lower Eocene
17. Cretaceous
18. AHRP transition zone
19. Reference point section

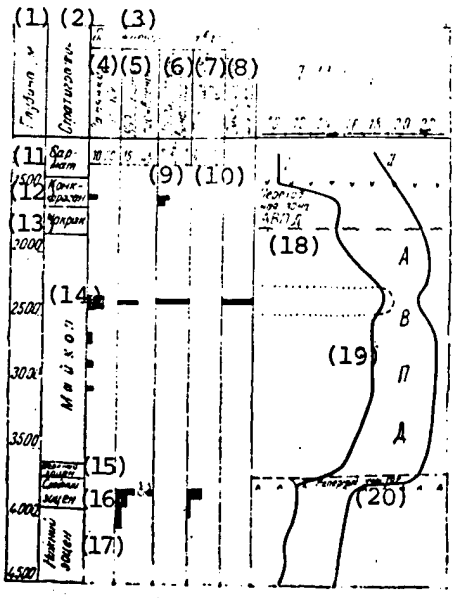

Figure 2. Damirtapa-Udabno Area

Key:

1. Depth
2. Stratigraphy
3. Complications and failures
4. Drag, jamming
5. Water, gas and oil seepages
6. Rock lifting, cave ins, collapses
7. Circulation losses, m^3
8. Collapse of casing string
9. Weak
10. Intensive
11. Sarmat
12. Konk-Karagan
13. Chokrak
14. Maykop
15. Upper Eocene
16. Middle Eocene
17. Lower Eocene
18. AHRP transition zone
19. AHRP
20. Reference point section

As is evident from figures 1-3, the drilling process varies in relation to different stratigraphic formations. Thus the AHRP prediction for the Lower Sarmat, Konk-Karagan and Chokrak deposits of all areas exhibits a sharp increase in the pore pressure gradient from 0.0105 to 0.0148 MPa/m, typical of the AHRP transition zone. Gas seepages, drag and jamming of the drilling tool and lifting of sharp clayey cuttings are of insignificant intensity in this zone. An analysis of core material taken from the transition zone revealed a higher concentration of montmorillonite.

The predicted indicators of AHRP encountered during drilling of the Upper Maykop stratum indicate a smooth increase in the pore pressure gradient, which elicits a need for a stepped increase in density of drilling mud.

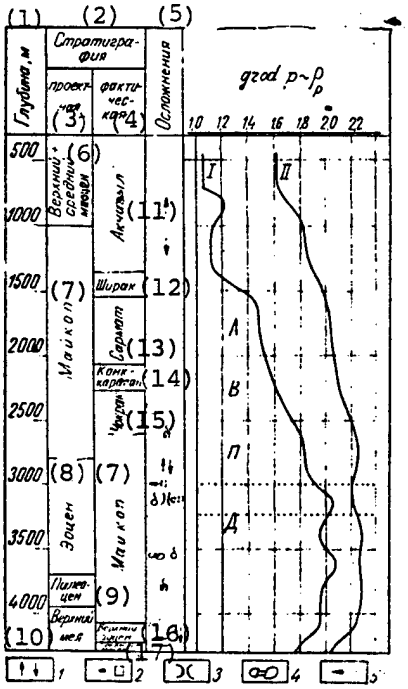

Figure 3. Gyurzundag Area: *1*--drag, jamming; *2*--losses of circulation coupled with reflux of drilling mud; *3*--narrowing of well shaft; *4*--profuse rock lifting; *5*--loss of circulation of drilling mud

Key:

1. Depth, m
2. Stratigraphy
3. Projected
4. Actual
5. Complications
6. Upper and Middle Miocene
7. Maykop
8. Eocene
9. Paleocene
10. Upper Cretaceous
11. Akchagyl
12. Shirak
13. Sarmat
14. Konk-Karagan
15. Chokrak
16. Upper Eocene
17. Middle Eocene

It was noted however that the change in gradients of AHRP became unusual 200-300 m below the roof of the Maykop deposits. The AHRP gradients increased sharply.

A large quantity of porous deformed clay of abnormally low density (ρ=2,010--2,020 kg/m^3) was lifted out with the drilling mud, intense drag and jamming of the drilling tool occurred owing to seepage of fluid clay into the well, gas seepages occurred from thin lenticular sandstone interlayers, and this was followed by loss of circulation of drilling mud and its subsequent reflux.

Analysis of the density of clay rock and other predicted indicators, the drilling process itself and geological and geophysical data confirmed stepwise growth in the AHRP gradient in the zone of fluid clay with high pore pressure.

Obviously the main reason behind the stepped increase in AHRP gradients is the high pore pressure of sealed blocks of uncompacted clay with an abnormally low density for this depth. These blocks receive the entire geostatic load of the overlying rock layer. This phenomenon is observed to be most intense in and around the crest of the structure, where besides geostatic pressure, tectonic compressing forces operate.

Loss of circulation of drilling fluid followed by its reflux occurs due to hydraulic fracture of rock at the contact boundary between deformed clay and sandstone lenticles characterized by high pressure and low volume. The hydraulic fracture gradient in the complicated zone is close in value to the AHRP gradient (see figures 1-3). Large caverns and constrictions form subsequently in these zones due to the flow of fluid clay having a high pore pressure. This is the reason behind the concentrated loads exerted upon casings.

When the tranverse load on the casing is nonuniform, its capability for withstanding collapse reduces sharply. This circumstance, when taken together with significant wear of casings as a result of lengthy operation of drill pipes in the casing, led to collapse of intermediate strings in wells No 3, 4 and 5 in the Sazhdag area, well No 1 in the Gyurzundag area and so on.

A characteristic form of complications associated with Upper and Lower Eocene and Upper Cretaceous deposits was loss of circulation of drilling mud. The main reason for this was discord between overlying clayey caps characterized by AHRP and fissured Middle Eocene rock with normal reservoir pressure.

To prevent this form of complications, the intermediate string must be set precisely on the roof of the absorbing bed, and the AHRP zone must be separated from beds with normal pressure.

Analysis of the conditions under which wells were drilled in the areas under examination here and investigation of the predicted indicators used in determining the AHRP zones and gradients as well as of cuttings and core material across the entire cross section of the wells showed that a clayey interlayer (which we called the "reference point" layer) from 5 to 15 m thick exists between the thick Maykop and Upper Eocene layers with abnormally high pressure and underlying fissured Middle Eocene rock with normal reservoir pressure. The density of this interlayer is abnormally high in comparison with clayey rock of identical age that is normally compacted for this depth (see figures 1-3).

Formation of a compacted interlayer may be explained by intensive compression of pore fluid out of bordering Upper Eocene clay characterized by AHRP into fissured Middle Eocene reservoirs with normal reservoir pressure in response

to the geostatic pressure of overlying deposits. When the drilling tool enters such an interlayer, the penetration rate and the footage per bit decrease sharply, in connection with which the drilling process must be stopped and a casing string must be lowered to isolate the AHRP zone from underlying fissured rock.

Thus analysis of the drilling conditions and research conducted in the course of drilling all wells in areas situated in the region between the Kura and Iori rivers made it possible to recommend the preliminary structure of the first exploratory well in the Tarsdallyar area and the density of the drilling mud to be used (Table 1).

Table 1

Наименование колонны (1)	Диаметр обсадной колонны, мм (2)	Глубина спуска колонны, м (3)	Плотность бурового раствора, кг/м³ (4)
Направление (5)	720	10	
То же (6)	630	30	1160—1180
Кондуктор (7)	508	200	
1-я промежуточная (8)	377	1700	1450—1500
2-я промежуточная (9)	273	2400	1950—2000
Потайная (10)	193,7	4000—2100	1250—1300
Эксплуатационная (11)	127×146	4500	1180—1200

Key:

1. String
2. Casing string diameter, m
3. String lowering depth, m
4. Drilling mud density, kg/m^3
5. Direction-setting
6. As above
7. Conductor
8. First intermediate
9. Second intermediate
10. Countersunk
11. Production

The AHRP zones and gradients were predicted in parallel with drilling the wells with the purpose of correcting the projected data--that is, the well structure, the string lowering depth, the density of the drilling mud and so on.

The predicted indicators were plotted to a depth of 2,882 m on the basis of the conducted analysis. These indicators included the d_s exponential curve, the density of clayey rock and the actual density of drilling mud. These data were then used to calculate the pressure and rock hydraulic fracture gradients (Figure 4).

The AHRP transition zone is ascribed by predicted indicators to Akshagyl deposits at a depth of 920 m, and it is characterized by a steady increase in the pressure gradient from 0.0105 to 0.0126-0.0130 MPa/m. The drilling process was accompanied by insignificant drag and jamming of the drilling tool and lifting of sharp cuttings.

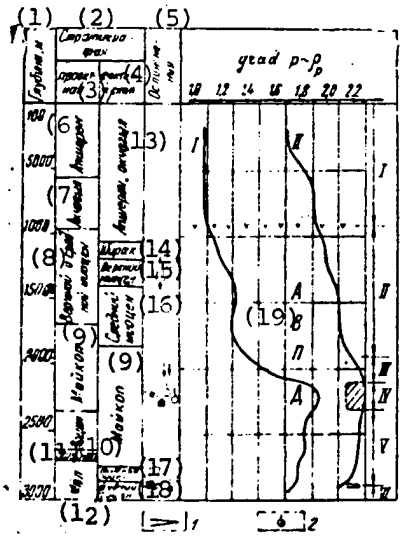

Figure 4. Tarsdallyar Area: *1*--reference point section; *2*--gas and oil seepages

Key:

1. Depth
2. Stratigraphy
3. Projected
4. Actual
5. Complications
6. Apsheron
7. Akchagyl
8. Upper and Middle Miocene
9. Maykop
10. Eocene
11. Paleocene
12. Cretaceous
13. Apsheron, Okchagyl
14. Shirak
15. Upper Miocene
16. Middle Miocene
17. Upper Eocene
18. Middle Eocene
19. AHRP

A more intensive but steady increase in the pore pressure gradient from 0.0130 to 0.0170 MPa/m is observed in the Upper Miocene and Upper Maykop deposits (1,700-2,050 m).

A zone characterized by a sharp increase in the pore pressure gradient from 0.0170 to 0.0196-0.0200 MPa/m is distinctly registered at depths between 2,050 and 2,270 m (Maykop deposits).

Its thickness is on the order of 150-200 m, and it consists of deformed unstable clay with thin lenticular sandstone interlayers characterized by low yield and high pressure.

The drilling of this zone using drilling mud with a density of ρ_p=1,800-1,850 kg/m^3 was accompanied by intense gas seepages from lenticular sandstone interlayers, profuse lifting of large chunks of plastic deformed clay with a density of 2,050-2,090 kg/m^3, and drag and jamming of the drilling tool.

Investigation of the pore pressure gradient and the hydraulic rock fracture pressure gradient in this interval showed that these gradients converge significantly (see Figure 4).

Further drilling of the well was carried out with a second shaft beginning at a depth of 1,935 m owing to disturbance of the integrity of the shaft and complications in the drilling process.

Complications of such great intensity were not observed during drilling of the second shaft owing to an increase in the density of the drilling mud to 2,010-2,050 kg/m^3. Further deepening of the well from the 2,250 m level into Maykop and Upper Eocene deposits as far as the roof of the Middle Eocene deposit (2,862 m) proceeded without complications using drilling mud with a density of 2,010-2,020 kg/m^3; the pore pressure gradient declined, stabilizing itself within 0.0178-0.0176 MPa/m. However, beginning at 2,862 m the values of the d_s exponential curve and the density of drilled clayey rock increased dramatically, attesting to presence of a thin "reference-point" interlayer in the 2,862-2,868 m interval (see Figure 4). After this interlayer was exposed, loss of circulation of drilling mud with a density of 2,000-2,010 kg/m^3 began. It was decided to lower an intermediate string with a diameter of 193.7 mm to a depth of 2,868 m, as far as the roof of the Middle Eocene deposit. After the string was lowered, a commercial flow of oil was obtained from Middle Eocene deposits with a reservoir pressure gradient of 0.0176 MPa/m. The daily yield was 300 tons.

The results of research on the pressure gradients along the geological cross section permitted isolation of several different zones:

I--zone of normal pressure, 0-920 m interval;

II--zone of higher pressure from 0.0105 to 0.0130 MPa/m (AHRP transition zone), 920-1,700 m interval;

III--AHRP zone, intense growth of pressure gradient from 0.0130 to 0.0170 MPa/m, 1,700-2,050 m interval;

IV--complicated AHRP zone, unstable clay with high pore pressure gradient equal to 0.0196-0.020 MPa/m, 2,050-2,270 m interval;

V--AHRP zone consisting of dense clay with alternating sandstone interlayers, pore pressure gradient equal to 0.0176-0.0174 MPa/m, 2,270-2,862 m interval;

VI--productive zone, separated from AHRP zone by thin and dense clayey interlayer ("reference-point").

This discussion provides the grounds for concluding that for the drilling of wells in the Tarsdallyar area to be successful, the well structure must insure that zones with sharply differing pressure gradients are overlapped, that the time unstable clay in the upper portion of the Maykop deposits characterized by a high pore pressure remains exposed is short, and that the amount of resources and time taken to drill the lower portion of the Maykop deposits and Upper Eocene deposits with a lower pore pressure are reduced (see Figure 4).

Table 2

Наименование колонн (1)	(2) Диаметр, мм: колонны (3)	(2) Диаметр, мм: долота (4)	Перекрываемый горизонт (5)	Плотность бурового раствора, кг/м³ (6)
(7) I вариант				
Направление (8)	720	—	—	1160—1180
То же (9)	630	690	—	1160—1180
Кондуктор (10)	473	540	Апшерон, верхний агчагыл (15)	1160—1180
1-я промежуточная (11)	339,7	445	Нижний агчагыл, ширак (16)	1350—1400
			Верхний, средний миоцен (17)	1400—1550
			150 м верхней части майкопа (18)	1550—1800
2-я промежуточная (12)	245	311	1-я половина майкопа (19)	1950—2050
Потайная (13)	178	215,9	2-я половина майкопа, верхний эоцен (20)	1750—1850
Эксплуатационная (14)	114×146××168	139,7	Средний эоцен (21)	1750—1800
II вариант				
Направление (8)	508	630	—	1160—1180
То же (9)	473	590	—	1160—1180
Кондуктор (10)	339,7	445	Апшерон, верхний акчагыл (15)	1160—1180
1-я промежуточная (11)	245	311	Нижний акчагыл, ширак (16)	1350—1400
			Верхний, средний миоцен (17)	1400—1550
			150 м майкопа (22)	1550—1800
Потайная (13)	178	215,9	Майкоп, верхний эоцен (23)	1950—2000
Эксплуатационная (14)	114×146××168	151	Средний эоцен (21)	1750—1800
III вариант				
Направление (8)	630	—	—	1160—1180
То же (9)	508	630	Апшерон, верхний акчагыл (15)	1160—1180
1-я промежуточная (11)	339,7	445	Нижний акчагыл, ширак (16)	1350—1400
			Верхний, средний миоцен (17)	1400—1550
			150 м майкопа (22)	1550—1800
2-я промежуточная (12)	245	311	Майкоп, верхний эоцен (23)	1950—2000
Эксплуатационная (14)	168	215,3	Средний эоцен (21)	1750—1800

Key:

1. String
2. Diameter, mm
3. String
4. Bit
5. Overlying horizon
6. Drilling mud density, kg/m^3
7. Variant
8. Direction-setting
9. As above
10. Conductor
11. First intermediate
12. Second intermediate
13. Countersunk
14. Production
15. Apsheron, Upper Akchagyl
16. Lower Akchagyl, Shirak
17. Upper, Middle Miocene
18. 150 m of upper portion of Maykop
19. First half of Maykop
20. Second half of Maykop, Upper Eocene
21. Middle Eocene
22. 150 m of Maykop
23. Maykop, Upper Eocene

Thus for wells to be drilled successfully into Upper Eocene deposits in this area, the following variants of well structure and drilling mud density are recommended: variant I--for wells drilled through complex portions of the structure; variant II--for the roof area; variant III--for the flank and periclinal portions of the structure (Table 2).

The depth to which the conductor string is lowered is calculated using RD-39-2-910-83 [2].

If bits with a diameter of 311 mm are unavailable, reamers must be foreseen to widen the well shaft diameter to 311 mm.

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2. "Rukovodstvo po preduprezhdeniyu i likvidatsii pogloshcheniy na ploshchadyakh p/o Azneft'" [Manual of Prevention and Elimination of Circulation Losses at Drilling Areas of the Azneft' Production Association], RD-39-2-910-83, Baku, 1983.

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UDC 622.276.5.054.3

TUBING FAILURE ASSESSMENT PROMOTES EFFICIENT PUMP REPAIR

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 84 pp 32-35

[Article by A. G. Khanlarov, AzNIPIneft' (not further identified): "Assessment of the Operational Reliability of Upset Tubing in Wells (with the Azizbekovneft' NGDU as an Example)"]

[Text] Analysis of the operation of upset tubing at oil fields and of their wear shows that such tubing is often assessed subjectively, depending on the established traditions and the availability of the appropriate materials and equipment.

In some circles preference is given to complete replacement of a tubing outfit, especially in high-yield wells, while in others replacement of individual elements of the outfit is preferred. Thus in the first case upset tubing suitable for longer use is scrapped, while in the second the use of excessively worn and obsolete tubing in wells causes a sharp increase in the number of underground repairs required.

Wear of upset tubing in wells operated by tubing pumps is caused by mechanical wear due to friction against the sucker-rod coupling or the body of the sucker rod associated with corrosional or corrosional-erosional action of extracted products upon these parts.

It should be noted that tube wear varies in different sections of the well shaft. Tubing is subjected to the most intensive mechanical wear in curved sections of the well shaft, where the body of the sucker rod comes in contact with the tube. At the same time in vertical portions of the well shaft, tubing is subjected only to corrosional destruction elicited by highly mineralized reservoir waters and caustic gases.

Therefore premature replacement of certain elements of the suspension may be possible; however, if replacement of the outfit is to be planned correctly, we would need to make a realistic assessment of the condition of the tubing with regard for the degree of its corrosive and corrosive-mechanical wear.

This problem was solved by modeling the life of a tubing outfit subjected to corrosional-mechanical using a method of grouped consideration of arguments [1]. The effect of the entire set of physicochemical and mechanical factors was considered in this case.

Using a group of wells belonging to the TsDNG No 2 [not further identified] of the Azizbekovnift' NGDU [Petroleum and Gas Extraction Administration], this article presents the results of calculating tube reliability indicators, graphically illustrating irrational use of such tubing at the oil field (see table).

It is evident from the table that the outfit is replaced in a number of wells after one or two underground repairs brought on by leakage of liquid into tubing, it is replaced in other wells after 10-15 repairs, and in well No 1444 the outfit was not replaced until after 52 underground repairs. Thus the length of operation of a tubing outfit varies in different wells from 1 to 6 years, despite the relatively similar conditions under which this tubing is employed.

To permit calculation of the basic parameters characterizing the operational reliability of tubing in this group of wells--the probability of trouble-free operation of the tubing in time $\bar{t}$-$p(\bar{t})$, the probability of tube failure in time $\bar{t}$-$q(\bar{t})$, the frequency of tube failures in time $\bar{t}$-$a(\bar{t})$ and the intensity of tube failures in time $\bar{t}$-$\lambda(\bar{t})$--it was assumed that the distribution of tube failures is Gaussian. The differences in operating times of the tube outfits in the wells were accounted for in this case, and to simplify the calculations $\bar{t}$ was assumed to be a dimensionless parameter satisfying the condition:

$$\bar{t} = \frac{t}{T_к}, \qquad (1)$$

where t--current time of operation of tube outfit, days; T_K--total time of operation of tube outfit, days.

Figure 1 provides a histogram and normal distribution curve for suspension element failures observed on the average, for the well over time $\bar{t}$.

$$n_i = \frac{0{,}1\,N}{0{,}349\sqrt{2\pi}} \exp\left[-\frac{(\bar{t}-0{,}754)^2}{2\cdot 0{,}349^2}\right], \qquad (2)$$

where n_i is the quantity of tube failures in time $\bar{t}$; N--total number of tube failures observed in the well; 0.754--average tubing operating time until failure; 0.349--standard deviation of tube operating time until failure.

Assessment of the probability of the selected distribution using Kolmogorov's test shows that $P(\lambda_K)=0.98$, and that the hypothesis that tubing breakdowns have a normal distribution is valid.

Figure 2 shows the Weibul distribution curves for tubing reliability parameters:

$$p(\bar{t}) = \exp\left[-1{,}1\,\bar{t}^{3}\right]; \qquad (3)$$

$$q(\bar{t}) = 1 - \exp\left[-1{,}1\,\bar{t}^{3}\right]; \qquad (4)$$

$$a(\bar{t}) = 2{,}5\,\bar{t}^{1{,}3} \exp\left[-1{,}1\,\bar{t}^{3}\right]; \qquad (5)$$

$$\lambda(\bar{t}) = 2{,}5\,\bar{t}^{1{,}3}. \qquad (6)$$

(1) Скважина	(2) Горизонт	(3) Забой, м	Максимальное отклонение ствола скважины на отрезке 50 м (4)		Температура на забое, °С (7)	Минерализация воды, кг/м³ (8)	Содержание в продукции механических примесей, кг/м³ (9)	Длина хода полированного штока, м (10)	Число двойных ходов насоса в минуту (11)	Подвеска насоса, м (12)	Диаметр насоса, мм (13)
			по кривизне (5)	по азимуту (6)							
319	НКГ(14)	1668	1°30′	15°	47	63,9	1,38	2,1	10,5	1057	43
515	р (II—III)	1066	0 45	20	39	137,8	0,92	2,1	9	883	43
730	$НКГ_3$	1642	1 30	35	46	57,4	1,64	2,1	7	993	32
788	IV	1012	1 00	10	32	122,7	0,75	3,0	11	554	70
797	р (II—III)	1240	1 00	135	39	135,0	0,02	2,1	10,5	874	43
1127	IV_{cde}	1082	4 45	35	39	94,8	1,41	1,8	7	1009	32
1130	IV_{cde}	1663	0 45	85	39	114,1	—	3,0	7	1100	32
1240	р (II—III)	1064	0 45	120	39	131,9	1,09	1,8	8,5	889	32
1444	$НКГ_2$	1650	1 15	15	48	40,3	—	3,0	10,5	1269	43
1484	IV_{cde}	1120	0 45	90	39	50,1	0,30	2,7	6	1064	32

Диаметр, мм (15)		Дебит нефти, т/сут (18)	Дебит воды, м³/сут (19)	Продолжительность работы комплекта НКТ, сут (20)		Количество подземных ремонтов, вызванных заменой НКТ, за период работы комплекта труб (23)		Количество отбракованных труб за период эксплуатации комплекта (24)	
труб (16)	штанг (17)			фактическая (21)	расчетная (22)	фактическое (21)	расчетное (22)	фактическое (21)	расчетное (22)
73	22×19	2,6	29,1	722	425	11	3	56	7
73	22×19	0,5	18,6	1357	906	8	2	49	6
73	22×19	0,6	16,6	337	485	1	2	4	7
89	22	1,6	86,0	1226	470	7	3	29	8
89	22×19	0,9	31,2	1131	1457	—	1	—	3
73	22×19	0,3	3,6	341	544	1	3	1	6
60	22×19	2,1	6,6	2195	1157	14	7	65	25
73	22×19	3,6	3,8	875	1804	1	4	1	11
73	22×19	1,2	45,6	2424	663	52	4	309	29
60	22×19	2,0	10,2	328	260	7	5	24	16

Key:

1. Well
2. Horizon
3. Bottom hole, m
4. Maximum deflection of well shaft in a 50 m section
5. In curvature
6. In bearing
7. Temperature at bottom hole, °C
8. Water mineralization, kg/m³
9. Concentration of mechanical impurities in product, kg/m³
10. Polished rod stroke, m
11. Number of pump double strokes per minute
12. Pump suspension, m
13. Pump diameter, mm
14. NKG [not further identified]
15. Diameter, mm
16. Tubing
17. Rod
18. Oil yield, tons/day
19. Water yield, m³/day
20. Tubing outfit total operating time, days
21. Actual
22. Calculated
23. Quantity of underground repairs elicited by tubing replacement in period of tubing outfit operation
24. Quantity of scrapped tubing during outfit's period of operation

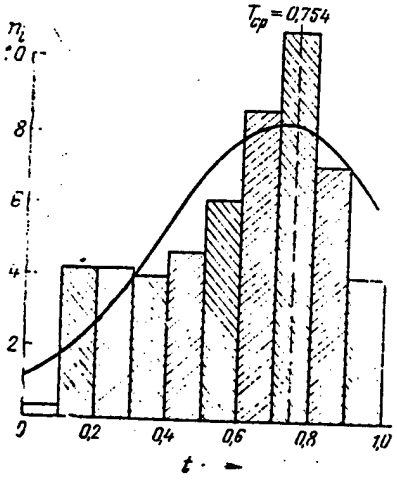

Figure 1

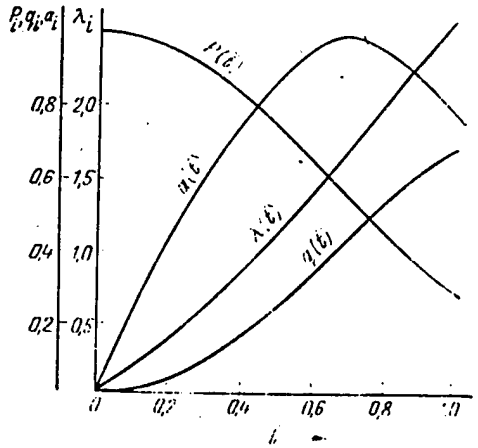

Figure 2

In this case the parameters of the Weibul distribution are 2.3 and 1.1 [2].

As is evident from Figure 2, the tubing outfit is replaced at the moment when the probability of trouble-free operation of the tubing in the well is 0.32. Superimposition of running-in failures of newly lowered suspension elements and failure of worn parts--old suspension elements--occurs in this case, and while the first repairs connected with replacement of worn tubing are carried out in wells every 5-6 months on the average, the latter are carried out every 3-4 weeks.

Assuming that replacement of a tubing outfit occurs at a time calculated by formulas [1], we drew a histogram and plotted a curve of the normal distribution of suspension element failures observed on the average in a well over time $\bar{t}$ (Figure 3), where $\bar{t}=1$ corresponds to the calculated time of operation of the tubing outfit.

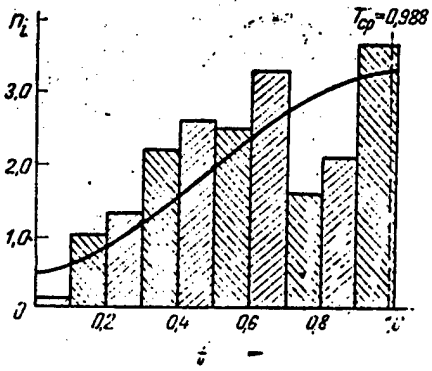

Figure 3

In this case

$$n_i = \frac{0{,}1\,N}{0{,}456\sqrt{2\pi}} \exp\left[-\frac{(\bar{t}-0{,}988)^2}{2\cdot 0{,}456^2}\right], \quad (7)$$

where 0.988--average operating time of tubing until failure; 0.456--standard deviation of operating time of tubing until failure.

As we can see from formula (7), the average operating time of tubing until failure is approximately equal to the calculated total operating time of a tubing outfit (T_{cp}=0.988), and the proposed mathematical models of the serviceability of tubing subjected to corrosional-mechanical wear [1] are acceptable for use in predicting the time of sensible operation of a tubing outfit with sufficiently high accuracy.

This is also confirmed by calculation of the parameters of tubing operational reliability:

$$p(\bar{t}) = \exp\left[-0{,}6\,\bar{t}^{2{,}3}\right]; \quad (8)$$

$$q(\bar{t}) = 1 - \exp\left[-0{,}6\,\bar{t}^{2{,}3}\right]; \quad (9)$$

$$a(\bar{t}) = 1{,}4\,\bar{t}^{1{,}3} \exp\left[-0{,}6\,\bar{t}^{2{,}3}\right]; \quad (10)$$

$$\lambda(\bar{t}) = 1{,}4\,\bar{t}^{1{,}3} \quad (11)$$

where 2.3 and 0.6 are parameters of the Weibul distribution.

As is evident from Figure 4, under these conditions replacement of a tubing outfit is carried out at the moment when the probability of trouble-free operation of the tubing falls below 0.5--that is, the probability of failure of elements begins to dominate over the probability of their trouble-free operation.

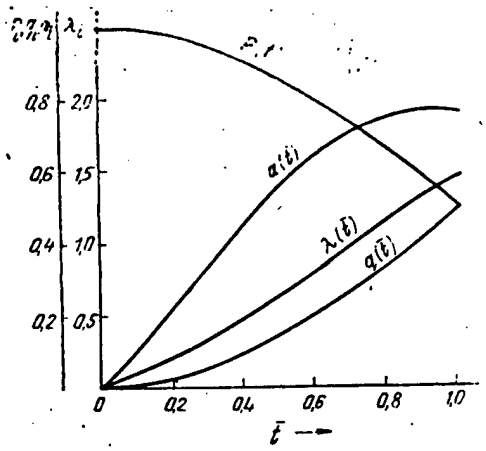

Figure 4

Tentative calculations of reduction of operating expenses were made for this group of wells (see table):

$$\Theta = \frac{365}{T_1}(C_1 + 0{,}15K_1) - \frac{365}{T_2}(C_2 + 0{,}15K_2), \quad (12)$$

where T_1 and T_2--actual and calculated operating time of a tubing outfit (the average values of T_1 and T_2 for the groups of wells shown in the table are equal to 1,057 and 854 days respectively), days; 365--number of calendar days in a year; C_1 and C_2--expenses of operating tubing in a well in the period of operation of a tubing outfit, correspondingly in relation to the actual and calculated times of the outfit's operation (outlays associated with delivering tubing, within the NGDU, outlays on underground well repairs brought on by tubing wear, and losses due to reduction of oil output during the well's down time for reason of underground repairs due to tubing wear are accounted for here), rubles/well; K_1 and K_2--capital outlays to acquire tubing during the period of operation of the outfit in the well, correspondingly in relation to the actual and calculated times of the outfit's operation (outlays on acquiring tubing to replace worn tubing, the residual cost of worn tubing discarded as scrap metal, the residual cost of tubing in the well that is worn but suitable for subsequent use for other purposes, and profit from selling scrap metal are accounted for here), rubles/well; 0.15--standard coefficient of the effectiveness of capital investments.

Calculations using formula (12) show that an economic impact of 790 rubles per well per year can be achieved simply by planning and promptly replacing the tubing outfits in the indicated group of wells.

Thus assessment of the status of tubing being used in wells and any decision on the fitness of this tubing for further operation or a decision to replace the outfit must be arrived at not subjectively but on the basis of previously planned tubing operating times related to specific conditions. In this case the time of sensible operation of a tubing outfit must be planned with regard for all of the physicochemical and mechanical factors affecting their serviceability.

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11004
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SIMULATED RESERVOIR FLOODING INCREASES CONDENSATE, DISPERSED OIL YIELD

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 10, Oct 84, pp 50-52

[Article by N. A. Belkina and M. S. Yagubov, AzINEFTEKhIM imeni M. Azizbekov (not further identified): "Possibilities for Lifting Condensate and Dispersed Oil out of a Gas-Condensate Deposit by Flooding the Reservoir"]

[Text] Flooding of partially depleted gas-condensate reservoirs is known to increase the relative yield of liquid product (condensate), which is accompanied by a significant change in the condensate's physicochemical properties [1-3].

This phenomenon is utilized, first of all, to monitor the movement of the gas-water contact and, secondly, when water invades the gas-condensate reservoir, displacing settled condensate out of the porous medium [4,5].

Dispersed oil is contained (sometimes in significant quantities) in the gas zone of gas-condensate deposits. Condensates settling from the gas-condensate mixture during exploitation of the deposit mixes with oil contained in the reservoir's pores, and when condensate is lifted out of the reservoir, the possibility of lifting oil arises as well.

Our objective was to assess the possible discharge of dispersed oil and settling condensate out of a reservoir in response to flooding of the reservoir. With this purpose we studied water displacement of oil and condensate out of a porous medium saturated by the former experimentally.

The experimental set-up is diagrammed in Figure 1. Column *1* was filled with porous medium that was successively mixed with certain quantities of water, oil and condensate. This column was then connected to a pVT bomb *2* filled with gas, and then gas was pumped through the porous medium (see Figure 1*a*). Gas exited the column through separator *3* and gas counter *4* until such time that the liquid phase began discharging from the porous medium. Then the pVT bomb was filled with water (see Figure 1*b*), and water was forced out of the bomb into the column containing porous medium *1* at a constant rate and a pressure of about 5 MPa. Water was pumped into the column until such time that water penetrated into trap *5*.

The volumes of the displaced hydrocarbon liquid phase, its density, its molecular weight and its concentration of oil and condensate were determined in the experiments depending on the amount of water that was pumped in.

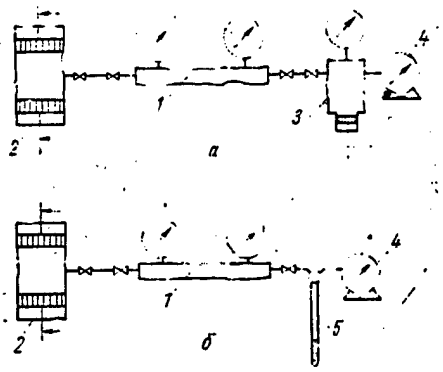

Figure 1

The table shows the conditions created in a porous medium with permeability k during the experiments; they correspond approximately to those values of water, oil and condensate saturation which may hold for the bottom-hole zone of a gas-condensate reservoir in the last stage of its exploitation to depletion.

$S_в$, %	$S_н$, %	$S_к$, %	$\frac{S_н}{S_к}$	κ, мкм² (1)
	$d_н = 839$ кг/м³ (2)		$d_к = 702{,}5$ кг/м³	
15	15	15	1,0	0,3
15	10	20	0,5	0,3
15	20	15	1,33	0,3
15	20	10	2,0	0,3
15	15	25	0,6	0,3
	$d_н = 907{,}1$ кг/м³		$d_к = 702{,}5$ кг/м³	
15	20	20	1,0	0,3

Note: Hydrophilic wetting is employed.

Key:
1. μ
2. kg/m^3

In all cases when water was forced into the porous medium to about half of its pore volume, displacement of the hydrocarbon liquid phase occurred, attaining a maximum of 40-50 percent of the initial quantity.

The concentration of oil in the liquid phase displaced from the porous medium in response to water injection gradually decreases (Figure 2).

The experiments showed that the relative quantity of oil in the displaced fluid is associated with the relative quantities of oil and condensate in the porous medium (Figure 3).

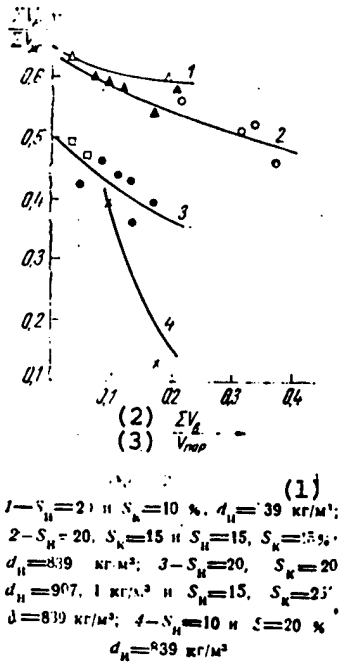

Figure 2

Key:
1. kg/m^3
2. water volume
3. Pore volume

It attains its maximum of 50-60 percent when

$$\frac{S_н}{S_к} = 1{,}5 \div 2 \; (S_в = 15 \; \%).$$

A similar pattern is observed for discharge of the mixture of oil and condensate from the porous medium when gas is pumped through a column containing porous medium mixed with water, oil and condensate [6]. In this case the maximum quantity of dispersed oil is discharged from the porous medium in the presence of a low value for the ratio

$$\frac{S_н}{S_к} \quad 0{,}7 \div 1{,}2.$$

The observed phenomenon may be explained by the fact that at maximum discharge of dispersed oil, $S_Н/S_К$ corresponds to the greatest unit surface area of contact between oil and condensate in the porous medium and their greatest mixing.

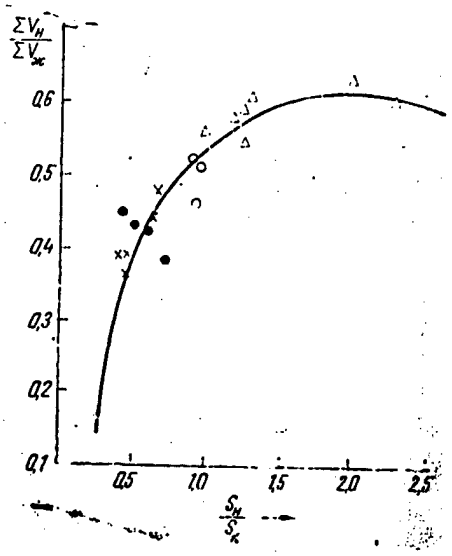

Figure 3

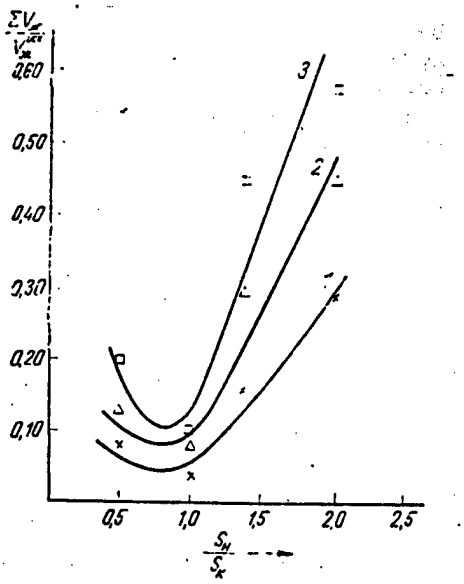

Figure 4

1,2,3--correspondingly $\frac{\Sigma V_w}{V_{pore}}$ =0.10, 0.15 and 0.2 when d_H=839 kg/m^3

With more-intense mixing of condensate and oil, when the unit contact surface is larger the displacement of the liquid phase from the porous medium is less significant, and consequently the losses of condensate are more significant (given the same quantity of injected water) (Figure 4).

Because of displacement by water, the initial saturation of the porous medium by oil and condensate decreases by about a factor of 2.

After the water bank breaks through, discharge of the hydrocarbon liquid phase does not cease; it continues to be displaced from the porous medium in individual portions, or in the form of a persistent water emulsion.

The obtained experimental results permit assessment of the possible discharge of dispersed oil and settled condensate from a gas-condensate reservoir in response to the latter's flooding.

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11004
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OFFSHORE DRILLING COST EFFECTIVENESS EXPLORED

Moscow IZVESTIYA in Russian 20 Oct 84 p 2

[Article by K. Abasov, chief, Kaspmorneftegazprom All-Union Production Association, Hero of Socialist Labor, USSR Supreme Soviet deputy: "Expensive and Disgraceful"]

[Text] Thirteen high-output wells were drilled and are now operating successfully at the oil deposit imeni 28 Aprel'. And it should be noted that this area's development is essentially the new word in Soviet shelf extraction. For the first time offshore oilmen strode to a place where the water depth exceeds 100 meters. In the next few years work is to proceed at the oil and gas bearing areas imeni Kaverochkin, Shakhovo-More, imeni 26 Bakinskiye Kommissary and others situated beneath 80 to 200 meters of sea. Thus the famous Neftyanyye Kamni, which had amazed the world in its time, is now but a child in the world of offshore oil extraction.

Rather than piers, these great depths require permanent platforms from which 10-20 wells could be cluster-drilled. The Kaspmorneftegazprom All-Union Production Association has been manufacturing such platforms through its own resources since 1981. Four steel islets have already been installed in the deposit imeni 28 Aprel'. Each of them is rather expensive--from 4.5 to 25 million rubles: It all depends on the amount of metal consumed, the drilling depth and the number of wells.

Platforms consist of two parts--a superstructure and supporting blocks. Capacities for producing them are being created in the current five-year plan. After these capacities are running at full load, each year the Astrakhan Ship Building Production Association and the Baku Deepwater Foundation Plant, the first generation of which went into operation last year, must supply Caspian oilmen with five permanent platforms adapted to sea depths of up to 200 meters.

We, the offshore oilmen, are of course pleased that the planning work was assigned to such authoritative organizations. And we hoped that they would utilize all of their scientific and technical potential to create highly effective, economical plans. But to put it mildly, an acquaintance with the first works of the planners compelled us to doubt the rationality of the decisions they made.

I did not cite the cost of the platforms which we built through our own resources earlier by accident. We are clearly discussing considerable state assets, millions of rubles. This would mean, then, that we should be spending this money with special care. But what do we find in fact? Equipment for the superstructures of platforms manufactured at enterprises of our association and intended for drilling to a depth of 5 kilometers costs 7-8 million rubles. But the plants intend to supply us with the exact same equipment but intended for drilling wells to 6,500 meters with a price tag of 50 million rubles. In my opinion such a dramatic difference in cost is far from equivalent to the outlays required for drilling an additional thousand and a half meters of wells.

We are even more apprehensive about the plan for the platform supports, drawn up by the TsNII Proyektstal'konstruktsiya [Central Scientific Research Institute of the State Institute for the Planning, Research and Testing of Steel Structures and Bridges]. Platform No 5, which was planned by the institute, is to require 15,000 tons more metal and 30 million more rubles than the similar platform No 3 which our association's Plant imeni Oktyabr'skaya Revolyutsiya is building. Moreover the time of construction at sea will later increase by 40 percent as well. This compels us to ask: What sort of concepts are embodied in the plans, if their implementation costs so much?

By the way, our objections stem more from just the excessive expenses, which would naturally raise the cost of every ton of oil significantly. We are also concerned by a number of other omissions in the developments of the TsNII Proyekstal'konstruktsiya, ones which are responsible for the excessively long time it is taking the Baku Deepwater Foundation Plant to produce the required metal structures. Figuratively speaking, the planners have assumed the path of reinventing the bicycle. Rather than developing a standard plan in accordance with the program for which the plant's production gear was intended, the TsNII Proyekstal'konstruktsiya is beginning each platform from scratch, and the enterprise is forced to lose great amounts of time waiting for the next manufacturing plans. Incidentally the Kaspmorneftegazprom Association has long been using the same procedure, it has a standard plan for use by its enterprise, and all of this is fully justified.

There are also some other problems, the roots of which must be sought in the plans: in transportation of finished foundations to the installation site, in the reliability of the diesel generators employed, and others.

In a word, we await from the planners a better understanding of the requirements and conditions of production, a more flexible, comprehensive approach to their developments and consideration of the accomplishments of science and technology. Only in this way will reliable, economical steel islands that will assist in extracting millions of tons of valuable fuel from the earth's interior appear on the Caspian.

11004
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COST, OTHER FACTORS IMPEDE OIL, GAS EXPLORATION

Moscow IZVESTIYA in Russian 15 Oct 84 p 2

[Article by V. Bidzhakov, chief geologist, Tomskneftegazgeologiya Association: "A Meter Drilled and a Ton of Oil, or What is Holding Back Exploration and Discovery of New Fuel Stores"]

[Text] Foreman V. Bobkov's brigade of the Vasyuganskaya Expedition is among the association's drilling brigades that completed their quotas for 4 years of the five-year plan ahead of schedule. But its "quick meters" bring me no joy. At the fault of the collective, wells in two new drilling areas had to be shut down, for technical reasons--that is how we refer tactfully to defective work that results in scrapping of a well. The drilling had to be started anew because the "window" to the 3-kilometer mark was spoiled. This cost hundreds of thousands of rubles. But the useless wells--and the useless production--were not reflected in any way in the brigade's indicators. The meters it drilled were added to its record as if they were useful, and they were paid for in full.

Work quality, which determines the main thing--growth in fuel reserves, is far from the main indicator of the brigade, and frequently of the oil exploration expedition as well. Its activities are evaluated in such a way that drilling volume is pushing oil production volume down to a secondary position and is becoming an end in itself. And how could it be otherwise, if the material well-being and prestige of the collective depend on drilling volume? To bridle the race for drilling volume, it is time to stop paying for wells with flaws and wells that are scrapped for technical reasons. We need to exclude them from the records of the brigades, expeditions and associations. Of course, the planning indicators will worsen immediately, profit will drop, and the size of the material stimulation fund will decrease. But one way or another, this unpleasantness will have to be endured sometime! There are a little too many useless wells, each costing the same as a nine-story residential building, being drilled in the country.

I can hear the objections now: Expedition leaders and specialists would lose their bonuses if they had to compensate for the losses. Let us not make more of this than there is: The sizes of the added rewards would be decreased only partially, and then not in all cases either. Waste is waste, and it must be reflected directly in basic wages. Otherwise the ruble will cease to be a stimulus of conscientiousness and responsibility.

Geology is a specific sector of production. Thus there is all the more reason for bringing the material interests of the collectives into correspondence with the interests of the national economy. More than enough appeals have been made to raise the economic and geological effectiveness of exploration. But the entire system of indicators and the conditions of socialist competition require improvement. Here is a specific and, once again, not unusual example. The oblast's best geological exploration enterprise is the Zapadnaya Expedition. Last year it discovered several deposits, and it surpassed its plan for growth of oil reserves and well drilling by a great deal. It achieved the highest productivity and the lowest cost per drilled meter. Most cargo was delivered in time to the sites of future drilling by winter roads and major waterways. Use of expensive helicopters was reduced, and about a million and a half rubles were saved. The derrick installing, drilling and testing brigades won all of the top positions in the association. Nonetheless the Perpetual Red Banner of the USSR Ministry of Geology and the Trade Union Central Committee was awarded to the neighboring Vasyuganskaya Expedition, the results of which were by far more modest. This happened not because of a misunderstanding or owing to someone's condescending favor: According to the terms of the competition, the Zapadnaya Expedition overspent its wage fund by 40,000 rubles, while the Vasyuganskaya Expedition saved 100,000.

The whole problem is that the concepts "savings" and "overexpenditure" are defined quite formally in this case. Moreover their initial meaning has been lost. The limits imposed on the manpower and wage funds of enterprises are calculated on the basis of the cost of work done by their own resources and the cost of services provided by others. Payment for expensive aviation is also added in. For the Zapadnaya Expedition, a savings of 1.5 million rubles carried a price tag of 250,000 rubles lost from the wage fund. The expedition added considerably to its own work load, and so there was not enough money. Had the collection used aviation without regard for anything else, it would have ended up with an enormous reserve of assets. Helicopters brought the Vasyuganskaya Expedition a quarter of a million additional rubles and the possibility for unrestrained disposition of what was actually someone else's money. And to top it off, it was declared the victor in the all-union competition. That meant a large bonus. There is an inconsistency here: Less is paid for better work, and moral stimuli are lost.

Thus it turns out that productive wells providing free-flowing oil and gas are unprofitable to the expeditions. The more empty or dry wells, as we call them, the higher productivity and all economic indicators are. This is because the most important and laborious operations are made unnecessary--casing, lowering pipe strings and sampling the underground horizons. These jobs require considerable technological and material support. Specialized brigades take weeks and sometimes months to conduct tests. But their share of the total cost of a well is just 10-12 percent. All of the tests bring less money to an expedition than a single additionally drilled well!

Of course, specialists and workers of all services are pleased and proud of discoveries, of oil or gas gushers. But these are holidays. Life, however, consists of routine days. Inasmuch as the stability of the economy and the blessings it brings forth are determined by artificial intermediate results and

not by the end goal--growth in reserves, the main efforts and concerns are centered on achieving these intermediate results. One may be amazed and astounded by the planning paradoxes, but everyone has to go along with them. Geologists awaited much from the transition to the new system of planning, financing and supporting drilling operations for oil and gas. I acquainted myself with the published instructions, and it became evident to me right away that quality--the basis of the end result--will continue to have an insufficient influence on the economy of enterprises. All of the internal contradictions remain.

The interests of different collectives participating in exploration are even more contradictory. Only expeditions are at all concerned about increasing the raw material reserves. Even the geophysicists, who pave the road to future discoveries by indicating their coordinates, are responsible only for the quantity and area of structures for deep drilling. To them, gushers and the tons or cubic meters of fuel extracted are in the realm of the emotional, and not at all the economic. The Tomsk Geophysical Trust is one of the best in the sector. It is invariably a candidate for top positions in the ministry-wide competition. It always fulfills its quotas for preparing structures. But gushers flow increasingly more rarely in new drilling areas. Geological effectiveness declined since the mid-1970s. The consequences were felt by the geological enterprises, but the geophysical ones remained untouched. How strange it is that the glory is shared by all, but only the expeditions are held accountable.

The "Statute on Phases and Stages of Geological Exploration for Oil and Gas" adopted late last year by the ministries of geology, petroleum and gas industry was to put things right to some extent, but it has not yet become a standard document. All of the great discoveries in West Siberia were made in relatively simple geological conditions. The producers knew the classical procedures, and that was enough in the first phase to discover and prepare deposits for development. And it was entirely natural for the sector's scientific organizations to focus their efforts on regional problems and to achieve significant successes in substantiating the raw material potential and the directions of its study. With time, prestigious large-scale problems of exploration essentially crowded out the meticulous research that is extremely necessary to improvement of exploration in its final stage. It is no longer enough to give advice on where to look. We need clear recommendations on how to look, supported by procedures, instruments and equipment fundamentally different from what is available today. Here is precisely where the gap formed between science and practice. In the sector, only the All-Union Scientific Research Institute of Geological Prospecting for Petroleum and the recently created Soyuzpromgeofizika Scientific-Production Association are regularly involved in detailed work.

It is rather easy to figure out why there is such excessive emphasis on "pure" research. When problems are stated concretely, and when they are made relevant to production, they always intensify and accelerate the personal responsibility of scientists for the quality and effectiveness of their recommendations. Moreover local research carried out for the needs of the sector in petroleum geology often borders upon and transforms into planning and design developments.

But this causes the projects to lose their outwardly scientific appearance, their academic prestigiousness and, of course, the possibilities for using such research as a basis for writing dissertations.

The oblast's oil prospectors are supported by the Siberian Scientific Research Institute of Geology, Geophysics and Minerals. What sort of practical assistance can we expect if the institute and its Tomsk department lack enough subdivisions to carry out the concluding phase of exploring a deposit? For example the oilmen asked us to get the Gerasimovskoye deposit operating on priority. It is to be responsible for almost the entire increment in extraction in the 12th Five-Year Plan. The Siberian Scientific Research Institute of Geology, Geophysics and Minerals was given the job of drawing up the plan for accelerated exploration of the formation. It hastily brought in another dozen institutes from all corners of the country as coexecutors. The coordination and all of the traveling will take up a great deal of time. And all of this will inevitably have an effect on quality. I am certain that this scientific research institute, the largest in the sector and the main one in its field in southern West Siberia, should have sufficient manpower to complete such projects.

Paradoxical though it may seem, calculation of the reserves in deposits of complex structure is a matter exclusively for practical experts. And we often find ourselves helpless. We discover a deposit, obtain abundantly flowing wells within it, but we are unable to transfer them to the producers. An attempt to add the first deposit of paleozoic oil--the Kalinovoye deposit--to the country's fuel balance ended extremely unsuccessfully. A lack of coordination in the actions of the oil prospecting partners graphically manifested itself in this case. Dependable supply of raw material to petroleum extraction industry must become the criterion of the collective efforts. Moreover this criterion must be embodied within an objective economic mechanism that would unite the end results--growth in reserves--with the interests of all, from the director of the scientific research institute down to the drilling foreman.

While I am discussing problems of concern to me, I do not at all claim to be the first to have discovered them. They are well known, but nothing is being done to correct them. It is the turn of the USSR Ministry of Finance, the All-Union Bank for the Financing of Capital Investments and the USSR Central Statistical Administration to act. And primarily for the sector's headquarters to act. Geology is a unique sector. It is at the boundary between science and production. In most cases it is impossible to draw a line between them. Nonetheless one would think that it should set the tone in terms of scientific and technical preparedness, level of organization and effectiveness of economic levers. For the moment it is not among the leaders. And this is doubtlessly restraining the search for and discovery of new stores of fuel, for which the demand is growing increasingly more acute.

11004
CSO: 1822/87

SCIENTISTS COOPERATE IN OIL, GAS GEOLOGICAL EXPLORATION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Oct 84 p 2

[Article by USSR State Prize laureate, Doctor of Technical Sciences P. Brodskiy, general director, Soyuzpromgeofizika Scientific-Production Association of the USSR Ministry of Geology: "Together with our Partners"]

[Text] Our association must support scientific-technical progress in one of the most important sections of geological exploration--studying material brought up by wells in the search for and exploration of deposits of oil, gas, coal, metals and other minerals. This is not one of the simpler tasks.

The Soyuzpromgeofizika consists of three all-union scientific research, planning and design institutes together with their experimental production operations, and two experimental-methodological expeditions responsible for introducing new methods and technical resources right in the field. Thus the scientific-production association is a single scientific-production complex capable of performing the entire cycle of scientific research and experimental design, setting up production of small series of the latest geophysical apparatus and organizing introduction of innovations into practice.

However, the machinery of scientific-technical progress slows down significantly and even skids to a halt when developments are transferred to series production. There are objective reasons for this: inconsistency between the possibilities of the plans of the Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems] and the growing demands of the geophysicists, the smallness of their production engineering and design services, and the wide assortment of articles called for by the plans. When combined with the reluctance of executors to complicate their lives with the troubles of introducing new equipment, all of this creates an easily erected but hard-to-surmount bureaucratic barrier.

Developers and manufacturers throw problems back and forth as if over a volleyball net. We send you documents, you send us demands to improve coordination of equipment supply and cooperative deliveries; we send you a corrected version, and you send us remarks from designers. We send you another corrected version, and you send us remarks from the process engineers. Each such "volley" takes a month, and before you know it, a year has passed.

Surmounting bureaucratic obstacles by exerting pressure is thankless and ineffective. And so we began seeking ways to reduce the barrier by "mutual penetration"--unification of the interests of the two sides. In general, this does not require all that much effort. On one hand the manufacturers need to be included in the early stages of development, so that the enterprise's production possibilities could be accounted for or developed in time. On the other hand we need to have the developers participate directly in assimilation of production of the articles, thus strengthening the small engineering services of the enterprises.

But finding the specific forms of such cooperation turned out to be difficult. We decided to first achieve coordination in work on problems within the integrated specific-purpose programs of the USSR State Committee for Science and Technology. The interdepartmental nature of these programs, which are itemized in the national economic plan, the need for specifying the deadlines and executors and the close control placed on their fulfillment by economic and party organs all create a good foundation for uniting the efforts of different collectives.

One of the very important projects in the integrated program of the State Committee for Science and Technology for reequipment of geophysical operations using wells is creation of the modern Oprobovaniye testing apparatus outfit. It can be used to test exploratory wells for oil and gas to a depth of 7 kilometers and in the presence of high pressure and temperature. The complex will also make it possible to reveal and assess productive oil and gas horizons right during the drilling process, and to obtain data for operational control of prospecting.

The apparatus outfit, which was developed by our association's institutes, successfully passed its interdepartmental acceptance trials last year. The Ufa Geofizpribor Production Association and the Baku Instrument Making Plant of the Minpribor are to organize their series production. Assimilation of series production was foreseen in the quotas for 1985. This meant that as usual, a small lot will have been produced by this deadline. And we would not be able to realistically await replacement of formerly produced obsolete apparatus until the middle of the next five-year plan.

This pace did not require the developers and manufacturers to work very hard: Reorganization of production to manufacture the new apparatus was pushed back several years. How can we talk about accelerating scientific-technical progress in such a situation!

Meanwhile the association has accumulated experience in cooperating with manufacturing enterprises. A laboratory of one of our institutes, the VNIIGIS [not further identified], was created in the Ufa Geofizpribor Production Association, and a subdivision of the VNIGIK [not further identified] was organized at the Baku Instrument Making Plant. These subdivisions are operating in accordance with plans approved by the plant and the institute.

This time, considering the importance of the work, we decided to take one more fundamental step toward each other by creating intersector creative collectives.

Besides colleagues of the research and design divisions of our scientific research institutes and of process engineering laboratories of the association's experimental production operations, workers of the process engineering and design services of the manufacturing plants were included in these collectives.

Experience confirmed that in an intersector collective, work is not divided into "yours" and "ours" and bureaucratic "volleyball" is totally excluded. The workers sit down together with manufacturers, and together with the plant designers, standard experts and process engineers they examine the documents and make corrections in accordance with their remarks. All output capacities and all reserves are on the surface, and they are utilized jointly.

Schedules were drawn up for joint work by the plants and institutes. These schedules foresee parallel fulfillment of the different phases of correcting the documents and of preparing the production processes; they also foresee participation of the developers in creating the production gear, in testing and improving the articles and in joint solution of the complex problems of equipment supply.

Ways of material stimulation of such work were also found. The statute on bonuses presently in effect in the association not only encourages scientists to achieve their end result as quickly as possible but also allows for payment of bonuses to participants of intersector creative collectives out of the savings enjoyed in the wage funds of the institutes. Accelerated assimilation of production of the Oprobovaniye outfit was also included among the terms of the annual competition for completing extra work, the participants of which are paid bonuses irrespective of their departmental subordination.

Our calculations showed that the new form of cooperation with associates should insure assimilation of plant production of the Oprobovaniye outfit a year ahead of schedule. The progress made thus far shows that this pledge is being fulfilled. All of the technical documents have been corrected in cooperation with the plants. Cooperative arrangements have been made with plants supplying some of the necessary parts, and the production gear has been manufactured. The plants have already begun manufacturing the new articles. In the fourth quarter of this year consumers will receive the first series lot of the apparatus, and by 1986 the old apparatus will be completely replaced.

We are already beginning to think about making this experience of close creative cooperation not a chance occurrence but the basis of a well-tuned system of mutual relationships with enterprises of the Minpribor. The next phase in joint work should be completion of the development and assimilation of production of the Skvazhina-2 apparatus outfit for geophysical drill-hole research based on a program-controlled mobile computerized laboratory. Eight to ten times more of these outfits will be produced than the Oprobovaniye outfit, and the complexity of the articles is much greater. Seventeen organizations and enterprises of five departments are participating in this work.

It is my least intention to create the impression that everything is going for us without a hitch. There are internal difficulties, which we are working to surmount. But there are also a number of serious problems of a different sort having to do primarily with coordination of production plans, deliveries

and supply with the effort to assimilate the new equipment ahead of schedule and in quantities in excess of the plan.

The present system of submitting orders for materials and equipment is automatically holding back assimilation of new equipment by a year or two. For example if acceptance trials are conducted on an innovation in 1984, then the plant is entitled to place orders for materials and parts needed from the outside only in the first quarter of the next year, which would mean the orders would be for 1986. Obviously if we are to accelerate production of new equipment, we will have to establish a special system of material and technical supply.

In my opinion we also need to improve the practice of summarizing the results of competition within the sector--both in our association and our associates. Efforts to accelerate scientific-technical progress are practically not accounted for in any way in determining the winners. Enterprises and organizations which assume the responsibility of developing and assimilating new equipment do not receive any advantages in the competition over those which take care to see that their indicators remain constant and their product assortment remains stable.

11004
CSO: 1822/87

BRIEFS

DRILLING PLAN COMPLETED--The collective of the Al'met'yevskoye Drilling Operations Administration (Tatar ASSR) completed its four-year drilling program ahead of schedule in honor of the 67th anniversary of October. Since the beginning of the five-year plan, 1,590 wells were placed into operation. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 84 p 2] 11004

INNOVATIVE LIGHTING FIXTURES--Shevchenko (TASS, 18 Sep)--It has become brighter in shops of the oil pumping stations of Mangyshlak even though consumption of electric power was reduced by a factor of four. Devices developed by specialists of the Ukrainian department of the Tyazhpromelektro-proyekt Institute provide uniform lighting to the work stations. Scientists proposed locating the light source--high-power luminescent lamps--outside the buildings and then to "transmit" their beams through polyethylene tubes with an internal mirror layer. Soft diffuse light fills the machine room through slots in these tubes. All oil pumping stations have already been equipped with these light "transporters." Moreover there are plans to use the sun's energy here as well. Fulfilling the order of the oil extractors, the scientists have begun work on devices which would focus sunbeams during the day. [Text] [Baku VYSHKA in Russian 19 Sep 84 p 1] 11004

ULTRADEEP WELL FINISHED--Yakutsk--The first ultradeep well in the Asian part of the country has been drilled to its planned depth of 6.5 kilometers by drillers of the Vilyuysk Oil and Gas Prospecting Expedition. A program of oil field and physical research which will provide geologists with valuable information on the structure of the earth's crust in this region and help them determine the direction of further explorations has now been initiated here. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 22 Sep 84 p 1] 11004

KARACHAGANAKSKOYE GAS FLOWING--Experimental industrial operation of the Karachaganakskoye gas-condensate deposit, the deepest in the country, has begun. The first generation of the gas field has been placed into operation here. The first millions of cubic meters of "blue gold" were fed to a 140-kilometer gas pipeline which now connects the Karachaganskoye deposit with the Orenburg Gas Refinery. [By A. Gamov] [Moscow SOVETSKAYA ROSSIYA in Russian 30 Oct 84 p 1] 11004

CENTRALIZED GAS TREATMENT--Ashkhabad, 16 [Oct] (TASS)--Gas began entering the Central Asia-Center main today from the Seyrab gas field in the Central Karakum Desert, which has been accepted for operation. Builders of the gas fields in

the Karakum are laboring in complex conditions: Everything has to be delivered here from hundreds of kilometers away. Nonetheless the Seyrab field was outfitted in short time. What is making it easier is that a "cluster" of deposits has been explored in the Central Karakum Desert. The first of them, Uch-Adzhi, has already been placed into operation. An installation for integrated gas treatment assembled here is intended to handle the capacities of the neighboring fields as well. Therefore the gas at Seyrab undergoes only preliminary removal of impurities, and then it is piped to Uch-Adzhi. The Vostochnyy Uch-Adzhi deposit is to be set up in the same way. [By Yu. Shakhnazarov] [Text] [Moscow PRAVDA 17 Oct 84 p 1] 11004

PROSPECTORS EXCEL--The collective of the Ukhtaneftegazgeologiya Production Association has been credited with high achievements in labor. Discovery of three new deposits made it possible for geologists and prospectors of the Komi ASSR to surpass the annual plan for growth in oil reserves. The outstanding indicators are the result of selfless work by geologists, drillers and builders. Brigades led by foremen V. Bezruk and I. Savchuk of the Usinskaya Expedition, by A. Bataliyev from the Intinskaya Expedition, by V. Yeliseyev from the Ukhtinskaya Expedition and by S. Malyar from the Pechorskaya Expedition are now working on quotas for the 12th Five-Year Plan. [By A. Semenov] [Text] [Moscow IZVESTIYA in Russian 12 Nov 84 p 1] 11004

MORE OIL FROM KRASNOYARSK--Norilsk, 16 [Sep]--Far in the north of Krasnoyarsk Kray, in complex geological conditions, wells are being drilled in search of oil and gas by the collective of the Nizhne-Yeniseyskaya Oil and Gas Prospecting Expedition. The explorers of the deep have presented the country with many mineral deposits. The tone is being set in the shock work by V. Svyatov's brigade, which is conducting geological prospecting in the Suzunskaya area. It reported this week that a new flow of oil has been obtained from Siberian soil. The oilmen are now making the initial assessments of the promising fuel reserves. [By A. Dzyura] [Text] [Moscow PRAVDA in Russian 17 Sep 84 p 1] 11004

MANGYSHLAK OIL PRODUCTION--Shevchenko (KazTAG)--The plan for oil and gas condensate extraction was surpassed in Mangyshlak by half a million tons since the beginning of the five-year plan. Two-thirds of this quantity were obtained by the collective of the sector's leading petroleum and gas extraction administration, Komsomol'skneft', which is developing the new deposits. It reached the 5-million tons of crude per year mark, which was to be reached at the end of the five-year plan, ahead of schedule. With the help of scientists from Kazan and Krasnodar, the oilmen employed effective chemical and thermal methods of extracting the fuel from the very beginning of development of the Buzachi deposits. Oil is being displaced from the Kalamkas oil field by water thickened by a special polymer, and productive beds of the Karazhanbas oil field are being "attacked" with superheated steam. This has made it possible to raise the productivity of the oil wells by five times and reduce product cost 3 percent beyond the quota. [Text] [Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 31 Oct 84 p 1] 11004

STEAM GENERATORS FOR OILMEN--Taganrog--The Krasnyy Kotel'shchik Production Association has created a specialized section for series production of steam generators to be used by oilmen to inject steam into wells, thus facilitating

oil extraction. Experimental models of the equipment underwent testing at Siberian oil fields. [By V. Uzhakin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 17 Oct 84 p 2] 11004

FLOATING DRILLING RIGS--Vyborg, Leningrad Oblast--The collective of the Vyborg Shipbuilding Plant is staking its future in production on the pilot model of the Shel'f-4 floating drilling platform. It is intended for drilling into the seabed and extracting oil and gas in the country's coastal regions. The new offspring of the shipbuilders is an improvement over its brothers. Its characteristics are impressive: It weighs 20,000 tons, and it is about a hundred meters tall. Specialists of the Soyuzvzryvprom Trust had to widen the Morskoy Canal in order to allow the Shel'f-4 to leave the port. Tests will be conducted on the drilling rig in the Liepaja test area in the Baltic. It will be registered to Murmansk, and it will begin work in the Barents Sea. The Shel'f-5 drilling rig, which will be sent to Sakhalin, has also been launched into the water by the enterprise. The effort to create Shel'f-6 is proceeding at full steam. Models of shock labor are being demonstrated by V. Kocherin's shipbuilding brigade and USSR State Prize Laureate V. Kulikov's section assembly brigade, which assumed a watch in honor of Great October. [By G. Vladimirov] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 17 Oct 84 p 1] 11004

CHUKCHI OIL CONFIRMED--Anadyr--Geologists of the Chukchi Petroleum and Gas Prospecting Expedition isolated three productive horizons during the testing of well No 1. The well provided a flow of gas and condensate, which now allows specialists to conclude that the first industrial deposit of gas has been discovered on the Chukchi Peninsula. Exploitation of this deposit will be easy. [By V. Komarov] [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 26 Oct 84 p 1] 11004

YAMAL GAS-CONDENSATE-OIL DEPOSIT--Sabetta-Yakha, Yamalo-Nenetsk Autonomous Okrug--Drilling of the deepest well on the Yamal Peninsula was initiated by Tyumen geologists. It is located north of the Novoportovskoye oil deposit. "Scientists believe that the productive beds of Yamal Peninsula are like a unique 'layer cake'," said Ye. Teplyakov, chief of Glavtyumengeologiya, the administration for exploration and prospecting for oil and gas. "Gas is covered by the upper layers of earth, gas-condensate is located deeper, and oil is present at the very 'bottom'." The new well should confirm this hypothesis. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 30 Oct 84 p 1] 11004

NEW TURKMENISTAN GAS DEPOSIT--(Turkmeninform)--An industrial flow of gas was obtained from a well drilled by Askarbi Uzdenov's brigade from the Achakskoye drilling operations administration at the Babaarab area in the Zaunguzskiye Karakumy Desert. This confirmed the prediction made by geologists concerning the promise of this area. "Three exploratory wells were drilled in the Babaarab area back in 1973," said Z. B. Khusnutdinov, deputy chief of the Turkmengazprom All-Union Association. "As it has now become clear, the exploratory shafts were drilled just 150 meters short of the gas bearing beds at that time." Fuel now being obtained from a depth of 3,330 meters contains sulfur impurities. But this will not be an obstacle to accelerated introduction of the deposit into operation. Babaarab is located near the Gugurtlinskiy

and Severno-Balkuinskiy oil fields, where by good fortune the production facilities are intended for extraction and processing of gas containing sulfur impurities. At the same time a high concentration of condensate has been discovered at the deposit, in quantities not yet encountered at any other gas deposit in the Karakumy. Dozens of promising areas are now being explored in the east and south of Turkmenistan. Laborers of the Turkmengazprom All-Union Production Association are confidently working toward the goal they set for the end of the five-year plan--achieving an annual extraction volume of 81-83 billion cubic meters of gas. [Text] [TURKMENSKAYA ISKRA in Russian 21 Sep 84 p 2] 11004

CSO: 1822/87

COAL

PLAN FULFILLMENT UPDATED

Kiev UGOL'UKRAINY in Russian No 8, Aug 84 p 1

[Article: "Soviet Miner's Day"]

[Excerpts] Coal industry workers greet their professional holiday, Miner's Day, with a peaceful day of their vital work. Leading mining and tunneling brigades took part in the socialist competition to complete assignments of the 11th Five-Year Plan period by the 50th anniversary of the Stakhanovite Movement. There are good reports from the enterprises on the miners' collectives, who have achieved great successes in the socialist competition. The plan for the fourth year of the five-year plan period has been fulfilled ahead of time by the imeni Gor'kiy, imeni Zasyad'ko, and imeni Kalinin mines, and the Kuybyshev (Donetskugol'), Vinnitsa and Moskva (Shakhterskantratsit), the Krasnogvardeysk (Makeyevugol'), the Kommunist and Khartsyzsk (Oktyabr'ugol'), the imeni Sverdlov (Sverdlovantratsit), the Ukraina (Voroshilovgradugol') and the imeni 26th CPSU Congress mining administrations. Assignments for the fourth year have been fulfilled ahead of schedule by over 120 mining sectors, and about 180 recovery and 70 tunneling brigades, and up to 2.2 thousand faceworkers. The plan for the fourth year of the five-year plan period in mine construction was fulfilled by eight mine-construction administrations, and 15 tunneling brigades. The Spetstamponazhgeologiya Association is at work on the account for the fifth year of the 11th Five-Year Plan. The republic's coal enriching personnel are working successfully

According to UkSSR MUP [Ministry of the Coal Industry/Minugleprom], the plan for the first half-year has been completed as follows: by 100.2 percent for coal recovery, by 103.3 percent for carrying out preparatory work, by 102.7 percent and 103.3 percent for reworking run-of-mine coals and concentrate output, respectively, and by 103.8 percent for large- and medium-grade coal output. One hundred twenty-two mines coped with their accepted socialist obligations and 132 managed an increase in labor productivity. Production cost for coal was lowered by 0.5 percent and more by 142 mines. In 1984 it is planned, on the basis of integrated mechanization, progressive technology, advanced methods of organization of labor and production, and based on a strengthening of discipline, to recover one million tons of coal and extract 500 thousand tons of concentrate at the concentrating mills, all above the plan. The collectives of a number of enterprises have accepted upcoming obligations which call for an increase in the plans for coal recovery, for growth in productiv-

ity of labor and a lowering of production cost of output at mines, concentrating mills and in mine construction.

12659
CSO: 1822/22

COAL

IZVESTIYA COAL MINE PRODUCES SATISFACTORILY

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 p 3

[Congratulatory message from the UkSSR Communist Party Central Committee City of Krasnyy Luch, Voroshilovgrad Oblast, the imeni Gazeta Izvestiya Coal Mine, of the Donbassantratsit [Donets Coal Basin Anthracite Association]: "Congratulations On the Large Bonus!"]

[Excerpt] To the workers, engineering and technical personnel, and employees, to the party, trade-union and Komsomol organizations, and to the entire mine collective:

Dear Comrades!

The UkSSR Communist Party Central Committee warmly congratulates you on your 50th anniversary since founding of, and the awarding of the Certificate of Honor of the Presidium of the UkSSR Supreme Soviet to the mine.

The imeni Izvestiya Coal Mine has made an enormous contribution to the industrialization of the country and the continuous provision to the national economy of power-generating fuel. The mine collective is constantly involved in a creative search for production reserves, and organizes many valuable initiatives. Since the beginning of the five-year plan period, 170,000 tons of anthracite have been mined, the relative share of coal recovery from comprehensively mechanized faces exceeded 70 percent and manual labor input has been reduced 1.2-fold. In answer to the party's call, planned labor productivity was increased this year by 12.9 percent and production costs for recovered coal were lowered by 6 percent, effecting a saving of R625,000.

12659
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UDC 622.013:65.011.42 "Mine imeni Gazeta IZVESTIYA"

LABOR IMPROVEMENTS OF THE IMENI GAZETA IZVESTIYA MINE COLLECTIVE

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 pp 4-5

[Article by A.S. Drabik, mine director: "Labor Achievements of Gazeta Izvestiya Mine's Collective," under the rubic "Practical Information Exchange"]

[Excerpts] The imeni Gazeta "Izvestiya" Donbassantratsit [Donets Coal Basin Anthracite] Association Collective is successfully at work fulfilling the plans for the 11-th Five-Year Plan. The mine's productive capacity is 800 thousand t of coal per year (2,650 t/day), and supported workings amount to 74 km. The mine is served by four vertical workings and four inclined workings.

The mine ranks in the highest category for methane elimination. Coal extraction and preparation operations are carried out below the 356-meter level. Air is supplied by VTsD-3.3, VTs-31.5 and VTs-5B ventilators from the main ventilation system. "Metan" automatic gas protection and "Veter" remote-control and remote-signalling devices are in operation. Active degasification of gas-bearing associated minerals of the formation is being carried out. Hauling is basically done by electric locomotives, using AM-8D and 2AM-8d electric locomotives, and at the cutting faces, model 1L-80, 2L-80, SP-63, SP-202 and SK-38 belt- and scraper-conveyers are used. The mine is equipped with "Kirovets" 1K-101 and 2KTsTG combines, 1MK-97D mechanized complexes, and PPM-4, 1PPN-5 and 1PNB-2 loaders. The 1_2^v Khrustl'skiy face, with a thickness of 0.85-0.95 m, and the Sadovyy face, with a thickness of 0.56-0.7m, and a 0-10° angle of dip, are being worked. The coal is from medium hard to hard. Faces are finished with a prognosis of blow-out danger. Four longwalls are being worked at the 1_2^v face, two of which are equipped with 1MK-97D mechanized complexes and two with "Kirovets" combines with individual supports and SK-38 conveyers. At the 1_2^n face, all four longwalls are equipped with 2KTsTG combines with individual support and SK-38 conveyers. Breakage-face length is 1,280 m. The mining method uses long columns (1200-1700m) to the up-dip.

Earlier mining operations were concentrated on the south, east and north walls of the mine near the main shaft. In time, their reserves were used up, the workings abandoned and the mine was developed only to the west. This intensive mining in one direction led to rapid removal (up to 13 km) from breakage and development faces from the pit-bottom and created a series of problems. The main problem was that of haulage. It was imperative that the problem of promptly and steadily supplying empty cars to the stopes, hauling out loads

and delivering people the long distance to and from the work be solved. In addition, as a result of the complex path of the rail tracks, the electric locomotives pulling empties or loaded cars were often unable to reach their assigned destinations along the western trunk line (the battery banks having insufficient capacity), and they blocked the way for the next train. As a result of overload, the motors for the electric locomotives broke down. An additional garage had to be built to charge the batteries and for preventive maintenance on the locomotives.

Space on the primary rail line was narrow, and there was only one work-track with a great number of switches and sidings for standing cars, and as a result almost 50 percent of haulage time was lost. One hour of idle time at the longwalls during shunting operations at the loading points caused a loss of 177 t of coal. It was decided for this reason to increase the sectional area of the from nine to 13.8 square meters inside, and to secure it with AP-13.8 arches and ferroconcrete lagging, which promoted repair-free maintenance. A second rail-way was laid in the working, which provided two-way traffic for the rolling stock, with their empties, loads etc.

The introduction of a cyclic routine for the car traffic, and also the bunker-type inter-car covers at the longwall loading stations, manufactured by the rationalizers M. M. Plotel', I. I. Putrya and V. A. Beskaravayn made it possible to push an empty car through for loading without switching off the conveyers, and to increase work and loading time at the longwalls.

Any increase in the coal recovery volume was repressed by the small carrying capacity of the shaft's skip car. The hoist engine was replaced by the higher capacity TsR4X2.5/0.6, and the six-ton skip was replaced by a nine-ton model, which increased the amount of coal brought up to the surface by 35 percent. And the obsolete cage hoist engine was replaced by the new 2Ts4X1.8 model.

The measures which were taken haulage work in the mine and improved the enterprise overall. An all-union record for coal recovery was set (over 24 thousand tons in a month) with a "Kirovets" combine, and the industry's highest monthly working on an electric locomotive (57 thousand t/km) was achieved. The UkSSR Minugleprom Advanced School has been organized, on the basis of the VShT [Higher School for Trainers], for the republic.

During the 9th and 10th Five-Year Plans, 118 km of development workings were completed, and over a million tons of coal were produced, all presupposing a successful effort during the 11th Five-Year Plan (See Table).

Indicators	1980	1981	1982	1983	1984 (4 months)
Coal Recovery, in 1000's tons	862.6	880.8	900.8	952.2	345.1
Percent of Coal Recovery Plan Fulfilled	98.8	100.9	102.9	108:8	114.9
Labor Productivity for Coal Recovery Workers	98.7	102.0	103.2	108.1	113.7
Percent of Recovery Level, Mechanized Complex Longwalls	54.3	57.7	52.3	69.3	65.6
Daily Average Mine Recovery, Tons	2483	2561	2560	2696	2916
Deviation in Production Cost for 1 Ton Coal, Compared to Plan, in Rubles	±0.28	-0.02	-0.15	-1.12	-1.5
Development Workings Completed, Meters	9759	9598	9174	9754	3138
Opening and Development Workings per 1000 persons, in Meters	7302	6267	6611	6541	2346
Percent of Plan Fulfilled, Development Workings	112.2	110.3	116.1	119.0	109.3
Percent of Plan Fulfilled, Opening and Development Workings, in 1000's persons	128.1	109.9	110.2	105.5	101.7
Percent of Plan Fulfilled, Labor Productivity, Tunneler	101.8	102.3	101.6	104.7	110.8

The constant search for production reserves has, in no small degree, fostered success. For example, if, during the initial introduction of the mechanized complex, 100 sets of supports were installed at a longwall 150 meters long in 15 days, then nowadays mine workers install 150 sets of supports at a 240-meter longwall in 7-10 days. Only as a result of lengthening the breakage face has the increase in daily recovery levels at a single longwall reached 440 t, and over seven thousand tons by virtue of time saved during installation.

To improve removal from stable holes, mine innovator P. V. Lavrega made and introduced a shortened end head for the SP-63 longwall conveyer, on which a 1K-101 upper combine comes and cuts the remaining bench, and the lower combine drives directly to the drift. There is no longer any need for drilling and blasting operations, or stopping work at the longwall, the shutdown of which causes 80-100 t of coal to be lost. Mechanizing stable-hole excavation freed six people who had been occupied in hole preparation.

During removal of the face, a brigade of helpers and electricians from two or three shifts worked on the removal of equipment from distribution points, disconnecting, covering, connecting and suspending cables. As a rule, the section didn't work for another one or two shifts after each removal. For developing and introducing new processing methods, all startup and regulating equipment is installed on mobile platforms which are drawn by an LPK winch as work advances along the wall. Or the conveyers are disassembled and reassembled beneath the longwalls. After the prescribed advance along the longwall, 8-10 men spent a day taking up the belt conveyer, and in disassembling, transferring and assembling the SP-63 scraper conveyer, and the longwall still could not be worked normally for another one or two shifts. Now they set up the conveyer drive on rigid scaffolding in a suitable place prior to pouring the coal from the scraper conveyer onto the belt conveyer. They clear away the structural components of the belt conveyer, and in their place, without dismantling it, they pull the 170-meter column of the scraper conveyer and connect it to the conveyer drive during one shift. The shortening of time spent in disassembling and assembling operations in connection with this makes possible the recovery of an additional two thousand tons of anthracite. One more example. At a meeting of the mine's technical council it was decided to use the ventilation cross-duct between the No 8 and 9 western inclines as a slot burner. This made it possible to equip and put into operation the 8th western comprehensively mechanized longwall, with a load of 1000 tons and more, and to effect an increase in recovery of 30 thousand tons of coal two months ahead of the deadline.

Mine innovators help locate production reserves. During 1981-1983 they developed and introduced 67 technical measures and 254 suggestions which had an annual economic effect of R399 thousand, and lowered the level of manual labor by 17 percent compared to 1980. Thanks to the efficient use of raw materials and power-engineering resources, 1,047 square meters of lumber were saved, 6.8 million kilowatt/hours of electric power, 26 t of explosives etc., were saved. By reducing the production cost of a ton of coal, 1.2 million rubles were saved, and 3.7 km of workings were mined above the demands of the program.

The decisions of the December 1983, special February 1984 and the April 1984 Plenums of the CPSU Central Committee have caused a new upsurge in labor activity. In January-April 1984, the daily recovery assignment being 3,015 tons, 44.7 thousand tons of above-plan anthracite were recovered, a reduction in production costs saved over 500 thousand rubles, and the highest increase in labor productivity among the industrial enterprises of the city of Krasny Luch was achieved.

Liquidation of repair and maintenance shifts and consolidation of mechanisms, equipment, support sections for electricians, crew foremen, mining foremen and mechanics promoted the increase in the volume of recovery from comprehensively mechanized longwalls in considerable measure. Thus, at the 7th western longwall, as a result of keeping strictly to the timetable for scheduled and preventive maintenance, checks of the working condition of mechanisms and equipment during idle time, for example in the absence of empty ore cars, the 1K-101 combine worked 1.5-fold more time than the set period, with no major overhauls.

The miners fulfilled their yearly obligations and took on new ones: the collective has decided to fulfill the plan for the fourth year of the 11th Five-Year Plan by 5 December and bring 80 thousand tons of above-plan anthracite up to the surface. Thanks to the excellent work of the tunnelers, the mine is being provided with a line of breakage faces. During six months of 1984, four longwalls were developed and put into operation. An additional muck bin was brought in, with a holding capacity of 250 t, making it possible to increase the carrying capacity of the elevator cage shaft by 15 percent, and to reduce downtime for hauling equipment by 25 percent. The delivery of mining crews by surface travel to the western incline shaft of Mine No 21 and back increased the carrying capacity of the intra-mine wheeled conveyences by 25 percent and shortened the travelling time for personnel by one hour.

Living conditions are being improved for the miners: housing is being constructed, and boarding houses are being repaired. The mine has a 110-place sanatorium-dispensary.

12659
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UDC 622.232.658.387 "Mine imeni 50th Anniversary of USSR"

GROZ BRIGADE WORK EXPERIENCE IN THE IMENI 50TH ANNIVERSARY OF USSR MINE

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 pp 6-7

[Article by Ye. I. Ivanova, of the Ukrzapadugo' [Western Ukrainian Coal] Association DNTI: Groz Brigade's Work Experience at 50th Anniversary of USSR Mine"]

[Excerpts] The imeni 50th Anniversary of the USSR Mine, part of the Ukrzapadugol' Association, was put into operation in November 1971 with a projected annual output of 900 thousand tons of coal. The mine is located in the southeast section of Zabugskiy, in the northeast sector of the Mezhdurechenskiy field. The field's dimensions are 5.4 km along the strike and 3.5 km down the dip. The mine is classified in a high category for monitoring of methane and explosive coal dust. The coal is mined by the system of long columns, the coal won in panels and one-piece longwalls, 170-185 m long. The mine is finished off in reverse order.

The imeni 50th Anniversary of the USSR Mine is one of the Lvov-Volyn Basin's leading enterprises. The mine fulfilled its plan for the year on 31 October 1983, having recovered 1.13 million tons of coal during the year, amounting to a 1.5-fold increase over 1982. The daily load at the longwall amounted to 798 t, whereas the association average does not exceed 450 t. The daily recovery level at the mine amounts to 3,213 t of coal, which is 313 tons above the plan. Labor productivity has increased by 15.9 percent against the plan, and and production costs per ton of coal have been reduced by 68 kopecks, thanks to which R584 thousand above the plan have been obtained.

A face with a complex structure has two and more rarely three humus coal benches and one or two rock interlayers, and the ash content of the coal fluctuates within the 35.2-39.2 percent range. The immediate roof is composed of medium-stability clay shale, from 1.5-3.5 m thick, and higher there are sandy shales which turn into sandstones. The method of roof control is by complete caving.

The longwall is mined by a KM-87e complex. Three 1L-80, and two SP-63 conveyers deliver the coal along the 2nd western trunk to the conveyer drift. Material is transported to the longwalls to bank and conveyer drifts in orecars and on the platforms of LVD-34 and LVD-24 winches.

A standard-size 1GSh-68 I combine works by a shuttle-style operation. The excavation seam is 62.5 cm wide. Thanks to using a 1GSh-68 combine which has two

automated cutters [samozarubyvayushciesya ispolnitel'nye organy] located at the ends of the chassis, they managed without stable-holes. The work schedule at the longwalls uses four shifts per day with a five-day work week. The first is a repair shift, the unit being composed of a combine operator, nine GROZ personnel, and three electricians. In addition to repairing equipment, the first shift clears off the drift of the 2nd western conveyor track, and delivers materials and equipment along the 2nd western main-line conveyor and the 34th bank drifts of the $p8^{v}$ face. Five support-installers and three rigging-delivery personnel work on these jobs. The unit is organized in the following manner: three GROZ-brigade members prepare the junction between the longwall face and the conveyor gate for moving of the conveyor and for a cut by the combine, and they support the lower section of the longwall.

The 1983 plan for coal recovery was fulfilled ahead of schedule. The brigade collective recovered a total of about 452 thousand tons of coal during the year, fulfilling the plan by 126.7 percent. The main reason for the successful fulfillment of the plan consists in the following: shortcomings in coal-recovery procedures, such as are connected with longwall No 34 lagging behind longwall No 28 by 300 m have been eliminated. A great effort was made, in spite of the poor condition of the KM-87 complex and line conveyor breakdowns, to recover coal at primary longwall No 34.

The miners have unresolved problems and complications. GROZ is obliged to complete a large volume of work which has no direct connection to coal recovery, such as setting up arched supports, rail tracks, piping and sundry equipment, and sometimes there are not enough spare parts for the worn-out mechanized complexes.

The brigade has also been working well in 1984. In five months over 214.7 thousand tons of coal were recovered and the plan was fulfilled by 134.5 percent. The brigade collective is certain that the year's plan will be fulfilled successfully, that they will reach the million mark for coal recovery and that they will manage the projected level of labor productivity growth.

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UDCS 622.272.8 "Severnaya Mine"

SEVERNAYA MINE OUTLINES NEW PRODUCTION CAPACITY, PROBLEMS

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 pp 8-10

[Article V. I. Mordasov, mine director: "Bringing Output Production to the Established Level at the Severnaya Mine"]

[Text] The "Severnaya" Mine, part of the Torezantratsit [Torez Anthracite] Association, is working the h_3^1 Removskiy face, the h_2^1 Podremovskiy face and the h_6 Gol'dshteynovskiy face, with a thickness of 0.62-1.1 m, and 16-35° angles of incline. Here and there the wall rocks are encroached with water and unstable; the faces are inconsistent in thickness and structure, and are characterized by the presence of a false roof, and by soils which are not dangerous due to explosive coal dust. The mine is worked by the continuous system, and by a combined system with division of a level into sublevels. The annual established production capacity for the mine is 480 thousand t of anthracite.

The mine came into being as a result of joining the workings of the No 32 "Pod"emnaya, No 32 "Ventilyatsionnaya", "Severnaya-1" and the "Severnaya-2" mines. The "Severnaya" mine became part of the "Zarya" Mining Administration, where primary attention was given to development of the base faces h_7 Kashcheyevskiy and h_8 Fominskoy and the removal of coal from the $h_2^{1б}$ and $h_3^{7}1$ was carried out within the boundaries of previously stripped reserves. For purposeful and effective growth of mining operation at these faces, a decision was made in 1978 to separate the "Severnaya" Mine from membership in the "Zarya" Mining Administration, into a separate production unit.

There arose weak points in the technological units of the mine, among which were:

the presence of four independent surface complexes, 2-6 km apart from each other;

the low carrying capacity of the basic main-line transport: the skip-cage shaft of what was formerly the No 32 "Pod"emnaya" Mine and the main incline shaft of the "Severnaya-1" Mine;

the need for a mine-car garage on three of the inclined shafts for rais-

ing and lowering people and materials;

the presence at the workings of two kinds of rail gages, (600 and 900 mm), and two kinds of transport equipment;

the need for separate ventilation for chambered workings at the 500- and 340-meter horizons (electric locomotive garages and a storehouse for explosives);

insufficient air pressure and output of operating ventilating equipment.

Massive material expenditures are needed to eliminate these weak points. In addition, problems have arisen which require urgent solutions. Among them are the absence of quality breakage face lines, and the insufficient level of mechanization at the faces. The indicated circumstances had a negative effect on work at the mine from 1979 to 1981.

In order to provide stable operation, in 1980 a combination of basic measures was decided upon to eliminate weak points in technological production units. The measures included construction of a new vertical shaft and surface complex on the site of the industrial area of the former "Ventilyatsionnaya" Mine; reconstruction of the hoist equipment for the skip-cage shaft, and replacement of shaft equipment, the hoist engine and the headframe; installation of a ventilation hole one meter in diameter and 500 m deep for separate ventilation of workings chambers at the 500- and 340-meter horizons; replacement of the ventilating equipment on the site of the industrial area of the former "Severnaya-2" Mine to improve ventilation of the workings at the h_2^{1b} and at the h_3^1 faces; stripping and preparation of western block reserves at the h_2^{1b}, h_3^1 and the h_4 faces, with loads removed through the "Severnaya-2" Mine.

All the technical measures were included in the plan for capital construction for the 11th Five-Year Plan, and planning-estimate and financing documentation was provided. At present, reconstruction operations on the skip-cage shaft have been completed. Workers from contract organizations have built a new hoist building and installed the hoist engine. Mine specialists have worked out a work organization schedule, have replaced the shaft equipment and have erected a new headframe which has no stop for the enterprise's basic transport line. They have installed the ventilation hole and the workings leading up to it and have built an electric locomotive garage and a storeroom for explosives at the 500-meter horizon, which has solved the problem of individual ventilation of chambered workings. In 1984 a ventilation plant will be erected at the "Severnaya-2" Mine, and a new vertical shaft and surface complex will be put into operation by the end of the five-year plan period. This is the way in which capital investments amounting to R6.6 million have been used for the technical re-equipping of the mine since the beginning of the five-year plan.

Along with this, measures were accepted in 1982-1983 to speed up development of mining operations at the h_3^1 face. A.G. Boyko's brigade completed sinking

the main and auxiliary shafts for the "Severnaya-2" mine very quickly, and the 5th horizon of the h_3^1 face has been prepared. Thanks to a high level of organization of labor and the use of internal resources, the monthly rates for incline workings were raised to 180-200 m (ordinarily, they had been 70-80 m, using the same equipment at the face).

The successful efforts of the tunneling brigades, and reduction of the time spent installing equipment insured timely preparation of breakage-face lines. At the same time, the problem of using them effectively was solved. A fluctuation in the angle of dip of the workable face from 16 to 35° and of the thickness of the seam of from 0.62 to 1.1 m, and also complicated mining geological conditions made selection of equipment effective for mechanization of coal extraction more difficult. For this reason, different types of mining equipment were used at the mine: at the h_6 face, which has an angle of dip of up to 25°, a 1K-101 combine, which has individual metallic supports, "Donbass-1G" combines with RS-1 chutes were used at the h_2^{1b} and h_3^1 faces, where the angle of dip is more than 25°, at the h_2^{1b} face, where the false floor had a slightly negative effect, a "Donbass-1G" which has individual metallic supports was used, and in the western part of the mine take, where there is a false floor, a "Temp", with wooden supports, was used.

The high labor intensiveness of the operations caused by using obsolete equipment precluded reaching high levels of coal removal at the breakage faces. During the 4th quarter of 1983, the mine's 6th western longwall was developed along the h_6 face, and equipped with a "Donbass" mechanized complex. Belt conveyor models 1L-80 and "Gvarek-1000", respectively, were used at the 6th western drift and at bank passage No 2. At a longwall length of 150 m, an extractable seam with of 0.8-0.9 m and an angle of dip of the face of 16-20°, the average daily load at the complex amounted to 587 t, the maximum being 1,100 t.

At the breakage faces of the 4th eastern longwall, along the h^{1b} face, which has an angle of incline of 20-25°, a 1K-101 combine was used, which operates with the frame from a non-collapsible, movable, self-loading DS-7 chute pan [stav].

The modification of the operation's processing method required a different organization of labor. A repair and maintenance shift was brought in, comprised of seven GROZ brigade members and three electricians who, in addition to providing uninterrupted equipment operation during the course of the day, did auxiliary work (lining cages, emptying stable holes, replacing chutes etc). Upon completing repair operations, the mechanisms were checked while loaded, and in the process, 50-70 t of coal were recovered. The qualitative and timely completion of preventive maintenance work reduced the amount of work-time lost from breakdowns of machines and mechanisms.

At section No 2 there are three production brigades, each consisting of nine breakage face miners. In the process of mining coal, the combine driver operates the combine, looks after the condition of the safety rope and cables, when necessary he sets up an additional support, and during movement of the combine from below upwards, he dismantles the safety partitions on the chute pan. A helper is occupied with adjusting the screws in order to provide optimal extractive performance, with seeing after the condition of the support and the roof of the face and when the combine moves from top to bottom, and raises the safety partition on the chute pan. The link leader is in charge of the brigade and looks after the quality and safety of the completed work. Two GROZ brigade members, using a hydraulic jack from the GP1UE-8 mover move the chute pan and at the same time clean the work area. Two more miners, at a distance of 15 meters from the combine, according to the movement of the conveyor, set up a face support in accordance with the chart of supports. Two miners look after the combine cable and carry the metallic beams to the stope and set them in the first row of supports.

Having abandoned the previous mining methods, there was no longer any need to form the face with the "Donbass-1G" combine, to assemble and disassemble the combine and the chute, to break the chute line or clean the area around the face manually or to drive the empty combine to the lower section of the longwall. Time spent in final operations has been reduced to a minimum. The longwall is supplied with two sets of baseplates used for attaching the draw-out rollers of the safety rope and the hauling chain (one set of which is at the job, and the other readied beforehand for the new repair shift tour of duty). At the terminal sections all operations are reduced, for all practical purposes, to moving the combine to the stable hole with the help of a ram.

This is how the introduction of new mining procedures using a higher level of mechanization for coal extraction permitted a reduction in the GROZ work force from 12 to 9 persons per cycle, a raise in the average daily recovery level, compared to the corresponding period of last year, by 70 tons (it amounted to 432 t), and fulfillment of the plan and socialist obligations taken on by the section collective.

This positive work experience was also used at the 1st western longwall of the h_6 face, where the average daily load at the longwall face amounted to 447 t, that is, higher by 90 t than previously achieved. By the beginning of 1984, practically all breakage faces being worked in conditions of sloping inclined seams were equipped with 1K-101 combines and DS-7 chute pans. The 1983 level for coal recovered with narrow-grab equipment reached 83 percent, compared to 32.4 percent in 1982, and the average daily load per longwall was increased by 20 t. Considering that the proportion of breakage faces on inclined seams is increasing, the changeover to mining with 1K-101 combines with DS-7 chute pans appears to be a temporary effective measure until the 1KM-103 complexes, for example, are brought in.

With the increase in the load at the longwall, it became necessary to provide an efficient mode of underground transport, the carrying capacity of which had been limited by the presence at the workings of two different rail gages, and, as a result, different-type hauling equipment. It was decided to change all workings over to 900 mm gage, which would allow VD-2.5 ore carts to be used to haul the coal. The railroad tracks had to be laid without stopping the operating transport lines. This was successfully accomplished thanks to the use of switch conversions, manufactured by mine rationalizers, which allowed timely operation of different-gage transport equipment at a single working. By 1983, the basic operations to convert the mine to a single railroad gage were completed.

The measures taken to eliminate weak points in technological production links, technical re-equipping of breakage faces, and the growth of the breakage face work front, created conditions for smooth operation of recovery sections and brigades, and for their fulfilling their socialist obligations. In 1982 the mine collective recovered 16 thousand tons of above-plan anthracite, and over-fulfilled their socialist obligations by 5 thousand tons.

Rates for coal recovery continued to increase in 1983. For the first time, since the moment the mine became an independent production unit, the established yearly production capacity, 480 thousand tons of anthracite, was reached. In addition to the plan, over 48 thousand tons were brought to the surface, and the labor collectives of all recovery sections successfully fulfilled the plan and the socialist obligations, which brought about an improvement in the basic technical and economic indicators (see table).

Indicators	1979	1980	1981	1982	1983
Coal Recovery, 1000's tons	441.9	457.1	387.8	468.0	528.3
Length, active breakage face lined, meters	967	886	688	794	899
Monthly labor productivity of miners, in tons	28.9	29.7	26.0	31.6	35.0

The mine collective supported the initiative to guarantee a yearly increase in labor productivity of one percent, and a 0.5 percent reduction in the production cost of a ton of coal. The socialist obligations which they have taken on, i.e., an increase in the yearly recovery plan of 50 thousand tons, oblige the collective to maintain their rates for growth and the technical re-equipping of the mine, and to seek out and put new production reserves into operation.

In accordance with the plan to develop the western block of seams, the 3rd western longwall of the h_3^1 seam was prepared and put into operation in February 1984, several months ahead of the deadlines stipulated by the program. Its operation was provided by a temporary transport network laid along Main Shaft No 2, from the 5th to the active 7th horizon to a coal chute which was fabricated from metallic ventilator pipes with a diameter of 0.8 meters. At the present time, primary attention is being given to construction of a new vertical shaft and the "Severnaya-2" mine's surface complex.

The accomplishment of the technical measures which have been decided upon is aimed at providing an increase of the yearly production capacity of the mine of 130 thousand tons of anthracite. The mine collective has taken on the obligation to recover 3,260 tons of above-plan coal by Miner's Day, and has in fact recovered 2,354 tons, in addition to the plan, during four months of 1984.

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CONDITION, MAINTENANCE OF WORKINGS AT MINES IN DONETSK-MAKEYEVKA REGION

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[Article by K. V. Koshelev, doctor of technical sciences; Yu. A. Petrenko, candidate of technical sciences; and A. O. Novikov, DPI (Donetsk Order of Labor Red Banner Polytechnical Institute) engineer]

[Text] At the increasing depths at which mines are being worked, and the complex mining geological conditions, difficulties in supporting mine workings are arising and costs for their reinforcement are increasing. As a result of an inspection of workings at a number of mines in the Donetsk-Makeyevka region, it has been established that the volume of deformed workings has increased by 13.2 percent during the period from 1970-1983.

The worsening of the condition of the workings is also corroborated by the increase in repair expenditures (Figure 1).

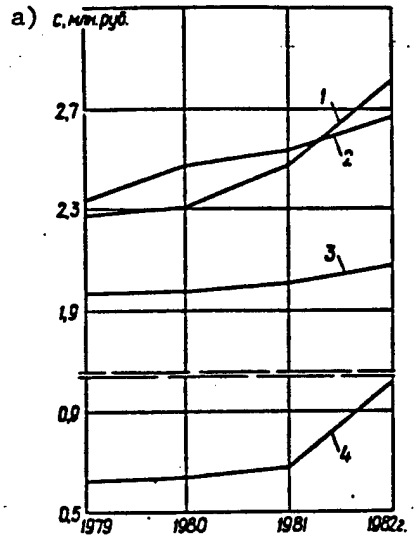

Figure 1.

Diagrams of factual outlays c for repair for given years at these mines:
1. imeni Chelyuskints (Donetskugol')
2. imeni Kalinin (Donetskugol')
3. "Krasnaya Zvezda" Mine Administration
4. "Chavkino" (Makeyevugol')

a. Cost, in millions of rubles

A great part of the expenditures are related to supports at developmental workings, the portion of which extend the overall length of the workings being 45-62 percent. Expenditures for supports for one meter of development workings supported by pliable metallic arches, and depending on the mining geological conditions, the area of the cross-section and the degree of deformation of the contour at the moment repair operations begin, fluctuates from 35-172 rubles per year, the average, according to the mines which were inspected, amounts to 82 rubles. Expenditures for supports in permanent workings which are supported primarily with reinforced concrete, concrete and mixed supports, depending on the very same factors, reach 80-290 rubles, with 196 rubles as the average.

Every year, 2-3 percent more workings equipped with pliable metallic and metal-concrete supports are repaired, and, at the same time, the extent of deformed sections increases constantly. Proportionat outlays for supports increases by 0.4-1.5 percent yearly, a fact which is explained by insufficient control over the condition of mine workings, the absence of scientifically based criteria of need, and the length of time for carrying out repair operations.

Repairs at the workings begin, as a rule, with the absence of required PB [safety rules] for clearance between mine transport and the support, and also with disturbances of the work schedule stipulated in the PTE [Rules of Technical Operation]. Workings which have baseplate supports, in 60 percent of the cases, are refastened with supports which are expanded up to the size of the next standard support, which increases the bearing capacity thanks mainly to the reduction in the spacing of the supports. The parameters for repair processes (starting time, duration, sectional area of the unfinished workings after repair etc.) are accepted on the basis of the experience or determination of the supervisor while repair and renovation operations are being projected in the mines' technical departments.

The degree of deformation of the workings, at the beginning of repair operations, will fluctuate from 12 to 85 percent. For example, the conveyor incline along the m_2 seam, which has a thickness of 1.1-1.3 m, at the "Chaykino" mine (Makeyevugol' Association), was constructed in 1977 by the drilling and blasting method, and with blasting of the roof and floor. The floor was composed of sandy shale with a compression strength of σ_{comp}= 59 MPa, and the roof was composed of sandy shale with a compression strength of 40 MPa. The support is the AP-11.2 arched, yielding, three-member type (area of interior cross-section is designed according to the formula S_c= 11.2 m^2, in a drift of S_n= 14.6 m^2); spacing is set at one meter, and lagging is wooden. The working is 766 m long. During the inspection, repair operations were being carried out on the incline. According to inspection data, the area of the cross-section was reduced accordingly down to 1.7 and 2.2 m^2 (by 85 percent, compared to projected dimensions. One hundred meters of the working were refastened without the use of standard-sized supports. Average outlays amounted to 217.7 rubles.

A haulage drift on the 5th western longwall of the k_8 seam at the imeni Chelyuskintsy Mine (Donetskugol' Association), was dug at the 882 m horizon by the drilling-blasting method, with undermining of floor rock. The seam was 0.9-1.1 m thick. The floor was composed of sandy shale with a compression strength of 42 MPa, and the roof was limestone with a compression strength of 88 MPa. Support was of the AP-11.2 arched, pliable, three-member type, with area of interior cross-section: S_c=8.8 m^2, and drift: S_n=13.1 m^2; supports were spaced at 0.8 m intervals; lagging was wooden. The working was 918 m long. By the time of the inspection the drift was deformed, and its cross-section was reduced by 40 percent. During repair work, the same support was installed. Proportionate outlays amounted to 189 rubles.

The time repair operations were started is not taken into consideration during refastening. Thus, the crosscut for the No 10 imeni Chelyuskintsy mine, which was dug at the 882 m horizon by the drilling-blasting method, and was repeatedly refastened during the operating period. The crosscut cuts across sandstone with a compressive strength of 80-100 MPa, aleurolite (siltstone) with a compression strength of 50-60 MPa and argillite (claystone) with a compression strength of 40-50 MPa. AP-13.8 three-member arched pliable supports were erected in the working (S_c= 13.8 m^2, S_n=17.9 m^2); interval spacing was 0.8 m, with ferroconcrete lagging. The rock dipped at an angle of 16°, there was a 5 m^3/hour influx of water, and the working was 1,486 m long. By the time (in 1978) of the next scheduled refastening, 250 m of the working were deformed with a 64 percent reduction in the sectional area. Cost of the refastening equalled 328 rubles per meter. This section was next repaired in 1979 at a 32 percent degree of deformation. Repair costs were 287 rubles. After three years, 130 m of the working, which had a degree of deformation of the sectional area of 41 percent, were refastened, the repair costs amounting to 293 rubles per meter. In this fashion, during six years of the operation of the working, it was repaired three times, with overall expenditures of 808 rubles per meter.

At the imeni Kalinin mine, the 5th western haulage drift of the h_7 seam (which is 0.8 m thick), was dug in 1975 at the 1,070 m horizon, by the drilling-blasting method, with two-sided undermining. The roof and the floor were composed of aleurolite with a compression strength of 50 MPa. The working was supported with AP-7.9 pliable, three-member, arched supports (S_c=7.9 m^2, and S_n=9.3 m^2); spacing interval was one meter, with ferroconcrete lagging. Bedding angle of the rock was 21°, with an influx of water of 17 m^3/hour. Within 30 months after the installation of the drift heading a section 190 meters long was deformed by 49 percent from the projected dimensions of the section. Refastening outlays amounted to 176 rubles per meter. After a year, the sectional area of the repaired section of the drift had been reduced by 25 percent. Outlays for a second refastening of a 215-meter-long section amounted to 152 rubles per meter. After 33 months, this very same section was deformed, with a loss of 40 percent of the section, and was refastened again. Outlays now equalled 184 rubles. Thus, for seven years of the working's operation, it was repaired three times, with overall outlays of 512 rubles per m.

In the cases described above, during repairs on workings with a degree of deformation of the cross-section of over 49 percent, secondary repairs had to be completed after approximately one year, and where there were deformations of from 25-32 percent, after 2-3 years.

It should be noted that the untimely completion of repair operations increases overall expenditures for support of the workings because of the increase in the degree of deformation of the encompassing geological mass, the zone of influence of the repair operations on sections contiguous to the repaired section grows, and on parallel workings which are located nearby.

The technology which is being used at present in repair operations in the mines is labor intensive, as many of the operations are conducted manually. The value and labor intensiveness of refastening the workings, depending on the degree of deformation of the contour when repair operations begin is shown in the table.

Support	Degree of Deformation of Contour, %	Repair Cost, rubles/m^2	Labor Intensiveness of Repair Man-hrs./m^2
Composite	15-75	19.3-25.6	0.18-0.49
Metallic pliable	21-85	18.6-24.2	0.16-0.45
Metallic rigid	17-58	18.9-23.8	0.20-0.52
Concrete	12-29	26.3-31.0	0.13-0.59
Metal-Concrete	13-42	28.7-39.1	0.21-0.78

In the Donetsk Polytechnical Institute, research is being carried out on the validity of the parameters for repair operations and the creation of technology to accomplish them. To produce a correct solution to the problem of the necessity and timeliness of beginning repair operations, the basic causes for the deformation of workings were established:

incompatibility of the technical characteristics of the supports to the conditions under which they were used (use of rigid supports in zones of nonuniform and intensive displacement), disparity of the direction of most displacements to the direction of flex of the support etc.;

incorrect wedging of the frame in the locks, and the absence of contact between the support and the rocks around the working, the careless installation of the stands over the support etc.;

repeated disturbances of the established equilibration of the composition of the rock mass, caused by the carrying out of mining operations;

the incessant growth of displacements in sections of the rock mass encompassing the workings (or the sections), which were located beneath the higher-located ore-blocks.

At present, widespread mine research is being conducted on the effect of repairing workings on the geomechanical composition of the surrounding mass, since without it being considered, it is practically impossible to resolve the problems of improving the technology of repair operations, and lowering the expenditures for equipment and labor for their implementation.

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IMPROVING THE PRICE LIST FOR WHOLESALE PRICES ON DONETSK COAL

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[Article by Candidate of Economic Sciences V.P. Golovin, the Ukrniiugleobogashcheniye (Ukrainian Scientific and Technical Institute of Coal Enrichment) Engineers L.N. Voronkova and P.N. Skarbo: "Improving Donetsk Wholesale Coal Prices*"]

[Text] In coal enrichment, the correlation of wholesale prices for run-of-mine coal and its concentrate products which have been put on the price list, as well as the standards for quality, and the system of accounting, all have major importance in stimulating improvement in the quality of the product. In 1982 a new list of wholesale prices for coal, concentrate products and briquets was introduced, which provided for a price increase and an appreciable change in the specifications for estimating ash content, sulfur content and moisture [1]. Prices for Donetsk run-of-mill coals and concentrates were raised differentially according to ranks and grades. The overall level of wholesale prices for run-of-mill coal was increased by 60.7 percent, and by 55.9 percent for concentrated coals, without taking the change in the specifications for quality into consideration [2].

In the case of a reduction of the old prices to the ash content standard of the new price list, the increase of prices according to the ranks for run-of-mine coal and concentrate amount, respectively, to: ZH--69.1 and 67.8 percent, K--62 and 67.5 percent, OS--65.7 and 74 percent, G--67.5 and 70.3 percent, D--74.3 and 77.7 percent, and T--65.1 and 66.2 percent. The discount (surcharge) for deviation of actual ash-content from specified norms was lowered for all types of coal output on the price list to 2.5 percent, instead of the 3 percent which had been in effect. The system of discounts (surcharges) for alterations in ash content at which maximum value for commodity concentrade products is achieved, as are, as a consequence, profits. For each commodity product, their are limits for the ash content of its individual fractions, an increase of which leads to a lowering of the overall value of all the products because of the considerable discounts. The ash content of zero-value fractions of run-of-mine coal and

*A proposal

concentrate products has been set by the Ukrniiugleobogashcheniye method (Table 1), just as the ash content of fractions of equal worth has been set for each pair of concentrate products according to the new price list (Table 2).

Table 1

Products	Ash Content (%) of Zero-Value Fractions by Coal Ranks					
	Zh	K	OS	G	T	D
Concentrate	47.8	47.8	46.9	47.8	54.5	48.7
Intermediate Product	80.5	80.5	80.5	80.5	80.5	80.5
Sludge	78.2	78.2	78.2	78.2	78.2	78.2
Run-of-Mine Coal	67.9	67.3	67.6	65.2	64.2	64.8

Table 2

Combined Products	Ash Content (%) of Equal-Value Coal-Product Fractions by Coal Ranks				
	Zh	K	OS	G	T
Concentrate-Intermediate Products	38.6	39.4	37.4	35.2	39.6
Concentrate-Sludge	42.4	42.8	41.3	40.6	46.6

An important feature of the new price list, in comparison to the one now in effect, is the increased limit values for ash content in fractions which are included in commodity products, said values stemming from penalty sanctions being reduced to 2.5 percent, and an increase in the specifications for quality. While being separated into two products (concentrate and rock), the ash content limits of the fractions desirably included in the concentrate rose to 46.9-54.5 percent instead of 40.6-43.7 percent according to the 1975 price list. The use of fractions which have an ash content which is below the limit makes it possible to obtain concentrate of maximum value. Consequently, at concentrating mills which have the technology capable of separating coal into two products, the introduction of fractions containing more than 50 percent ash content, which can be used in the national economy, is not encouraged by the price list.

During separation into three products (concentrate, intermediate products and rock), the limitation on ash content of fractions which are necessarily included

concentrate products has been set by the Ukrniiugleobogashcheniye method (Table 1), just as the ash content of fractions of equal worth has been set for each pair of concentrate products according to the new price list (Table 2).

Table 1

Products	Ash Content (%) of Zero-Value Fractions by Coal Ranks					
	Zh	K	OS	G	T	D
Concentrate	47.8	47.8	46.9	47.8	54.5	48.7
Intermediate Product	80.5	80.5	80.5	80.5	80.5	80.5
Sludge	78.2	78.2	78.2	78.2	78.2	78.2
Run-of-Mine Coal	67.9	67.3	67.6	65.2	64.2	64.8

Table 2

Combined Products	Ash Content (%) of Equal-Value Coal-Product Fractions by Coal Ranks				
	Zh	K	OS	G	T
Concentrate-Intermediate Products	38.6	39.4	37.4	35.2	39.6
Concentrate-Sludge	42.4	42.8	41.3	40.6	46.6

An important feature of the new price list, in comparison to the one now in effect, is the increased limit values for ash content in fractions which are included in commodity products, said values stemming from penalty sanctions being reduced to 2.5 percent, and an increase in the specifications for quality. While being separated into two products (concentrate and rock), the ash content limits of the fractions desirably included in the concentrate rose to 46.9-54.5 percent instead of 40.6-43.7 percent according to the 1975 price list. The use of fractions which have an ash content which is below the limit makes it possible to obtain concentrate of maximum value. Consequently, at concentrating mills which have the technology capable of separating coal into two products, the introduction of fractions containing more than 50 percent ash content, which can be used in the national economy, is not encouraged by the price list.

During separation into three products (concentrate, intermediate products and rock), the limitation on ash content of fractions which are necessarily incl-

in the concentrate fluctuates within a range of 35.2-39.6 percent. Intermediate fractions which have an ash content, the lower level of which stands at 35.2-39.6 percent and an upper level of 80.5 percent are expeditiously included in the Intermediate Products (Table 2). Observation of these conditions permits commodity products of maximum value to be obtained. In addition, the allowable limit of ash content (80.5 percent) of fractions headed for an Intermediate Product, is raised. This inclusion into an Intermediate Product, and the burning at thermal power stations of fractions with such ash content, is hardly advisable. Abroad, the ash content, set for fractions used as commodity products for power engineering, equal 65-75 percent.

To evaluate the role of stimulator, which the price list plays in improving the quality of concentrates, the balances of products at various densities at mills which reprocess coal for coking are taken into consideration. Calculations for these balances show that the maximum value for commodity products is achieved for concentrate and intermediate products by a specified ash content which corresponds to the separation density, and at a limited ash content of 35.2-39.6 percent (depending on the coal rank), and 80.5 percent for intermediate products obtained from coal of all ranks. In the majority of cases, however, the calculated ash content for products (concentrate and intermediate products) exceeds established norms, and at a number of mills does not correspond to GOST [State All-Union Standard] requirements. In order to fulfill the established norms for quality for these products, the mills have been compelled to abandon economically expedient separation processes which provide maximum recovery of fuel mass, and greatest sale value of the product.

In order to create conditions favorable to the optimization of the concentrating process, price-list calculation standards for ash content and for the size of discounts (surcharges) need to be specified which take into consideration the consumers' requirements regarding product quality and the obtaining of the maximum result. The calculated norms for ash content in the price list have been set based on average norms for standards of quality which have come about from the enterprises, and which were in effect at the time the price list was developed.

It is suggested that two groups of average calculated norms for ash content and for amounts of discounts (surcharges) be established per one percent of deviation, and also two groups of par value prices. The increased discounts (surcharges) must be applied during production of the concentrate for technological objectives with high requirements for quality. A large calculated norm for ash content should be set on concentrate for power engineering.

Changes in the conditions for calculating moisture content in coal have also been introduced. Discounts (surcharges) for deviations of one percent in the actual moisture content from the average calculated norm have been set in the amount of 1.3 percent off the wholesale price for run-of-mill coals, and classified anthracites, and two percent for coking concentrates. Calculated norms have been accepted on the level of the GOST's. A single calculated norm has been set for coal concentrates of the Zh, K and OS ranks, as well as for run-of-mill coals (GOST 537-79), i.e., 6 percent. It is lower than the actual

moisture content of concentrates used for coking. At an actual moisture content of 9.5 percent and a set discount of 2 percent off the wholesale price for a 1 percent increase in moisture, the overall discount amounts to 7 percent. At a 43.5-47 ruble price per ton of concentrate, the discount for exceeding the calculated norm for moisture will amount to over 3 rubles.

With regard to the volume of concentrate with an icreased moisture content, the uncompensated part of the discount amounts to approximately 1.5 rubles per ton. It is not provided for in the rated price for concentrate, and as a result, concentration of Zh-, K-, and OS-ranked coals has become unprofitable.

In this connection, a limit for moisture according to GOST 537-79 during the winter season should be adopted as 9 percent for the indicated coals. The establishment of such a norm will create a real basis for stimulating improved coal quality regarding moisture, and will permit concentration mills to receive supplementary payment. At the calculated norm of 6 percent, the mills have no supplementary payments for reducing moisture in concentrates, since it is impossible to achieve the indicated norm according to the technical conditions of the drying process.

Acceptance into the price list of a reduction of discounts (surcharges) on the price of power engineering coals of ±1.3 percent for moisture content for a 1-percent deviation is, in our opinion, groundless. For power stations, which are the basic consumers of such coals, the effect of moisture on the efficiency of combustion is comparable to the effect of ash content. At a 1-percent increase in moisture, the combustive heat of Donetsk coals is lowered by 349 kilojoules/kilogram, and the ash content by 315 kilojoules/kg. Consequently, the rate for discounts (surcharges) for a 1-percent deviation in moisture in power engineering coals needs to be raised considerably, and set at ±2 percent, just as it is for coking and brown coals.

In the new price list, norms for sulfur content in coals have been established just as provided for in GOST-537-79. Calculations for sulfur content in coking coals have been changed considerably: group prices for ranks have been abolished and a discount (surcharge) of 1 percent of the wholesale price for a 0.1 percent deviation from the established norm for sulfur content has been introduced. This rate has turned out to be inordinately high, and has created conditions for making unjustified profits (at a better quality of coal according to a given indicator) or losses.

Monetary calculations for sulfur content of Donetsk coals should stimulate mining of the less sulfurous of them and the advantageous use of the more sulfurous for power engineering purposes. However, as a result of the scarcity of Donetsk coking coals, their entire volume is used only for coking. Coal mining in the Donbass cannot be carried out on the principle of the preference of some reserves over others. Because of mining reserves with mining geological condition favorable to development, all the conditioned, and in a number of cases, non-conditional reserves are involved.

Considering the low effectiveness of coal concentration on the sulfur content, and the scarcity of Zh-, K-, and OS-ranked coals, it would be advisable to eliminate calculations for sulfur content. A lowering of the rate from 10 to 3 percent of the wholesale price for a 1 percent deviation in sulfur content can be recommended as an intermediate measure.

The shortcomings of the new price list which we have noted have had a negative influence on the profitableness of concentrating mill operation and the use of resources. As a result of changing over to the calculations on the new price list coal concentration has become unprofitable.

Concentration of only T- and G-rank coals for coking is profitable, and it makes a profit of 1.2 and 0.9 rubles, respectively, on a ton of run-of-mine coal. Processing the coals of the remaining ranks according to the calculations on the new price list is unprofitable. The greatest profits are made at mills concentrating caking coals from Zh, K and OS ranks (0.7 rubles per ton of run-of-mine coal). As has been emphasized above, the principal cause of unprofitability in concentrating coals of these ranks is the setting of lowered calculated norms for moisture in concentrate in the price list. However, mills with high technological efficiency can make large profits.

On the basis of what has been presented, we can draw the following conclusions. With the objective being the improvement of the price list, it is suggested that the system of calculation for concentrate be differentiated, depending on the requirements for quality set forth by the consumers. In the first place there is a need to establish two levels of starting points for calculations for ash content and rated prices for G-rank coals, and also an increased discount (surcharge) toward the price for concentrate for technological use with high requirements for quality.

Considering the low effectiveness on sulfur content of concentrating Donetsk coal, calculations for that indicator should be eliminated, as they have done for the coals of other basins. Initially, a lowering of the rate from 10 to 3 percent off the wholesale rate for a 1 percent sulfur content deviation can be recommended. In order to calculate for moisture in Zh-, K-, and OS-rank coal concentrate, we need to set the calculated norm at 9 percent, and the rate for discounts (surcharges) of ±2 percent of the price which is spread throughout all coal output, after having eliminated the ±1.3 percent rate.

Improving the price list in these directions will promote a more active reflection of the national economic effectiveness in the process of preparing coal prior to use, and increasing the effectiveness of operations at concentrating mills.

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12659
CSO: 1822/22

INNOVATIONS IN MINING TECHNOLOGY

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 p 26

[Brief notes: "Innovations in Mining Technology"]

[Text]

Transport Unit for 45° Inclines

KNIUI [Kuznetsk Scientific and Research Coal Institute] has developed the ISTG transport unit, designed to haul additional loads along the rectilinear inclines (up to 45°) of mine workings. It consists of a transport vessel, one or two winches, and is run along rails which are laid on sleepers. It can transport loads up to 600 m, and where the coal seam is inclined up to 15-20°, the unit is equipped with two winches, and with one winch where the incline is greater than 20°. In the latter case the winch is equipped with two brakes and the vessel is equipped with a speed retarder.

New MGPP-3a Drive Combine

The MGPP-3a mechanical-hydraulic cutting combine, designed for carrying out workings with a sectional area of five square meters in rock with a hardness of up to 6 on the Protod'yakonov Scale has been developed by VNII gidrougol' and the Gidrougol' Association's Gidromash Plant SKB [Special Construction Bureau]. The combine uses a hydroturbine drive which supplies waste water to the area where the cutting tools contact the rock mass, cooling the cutting tool and suppressing dust. The MGPP-3a consists of an arrow-shaped actuating element, a caterpillar drive, two drilling units, hydraulic systems, articulated piping, a dust suppressing system and lighting equipment. The actuator is equipped with a drill bit with ShBMG [Possibly--drum-type ball mill head]and RPM [rotary loading machine] cutters. The combine's stability is provided by a thrust to the sides of the working, and the rock broken off from the face is hauled off along a trench by water pumped by the turbomotors. The bore holes for anchoring supports are drilled with tractor-mounted rigs. According to test results, the MGPP-3a combine has been recommended for operation at the Gidrougol's Association's "Inskaya" Mine.

New GPI Remote-Control Excavator

The GPI self-propelled hydraulic excavator which is equipped with an impulse pressure booster and remote control has been developed by VNIIgidrougol'. A caterpillar truck off a series-produced K-56MG tunneling combine is used as the drive unit, on which the remote-control device, the hydraulic system and the impulse pressure booster, which includes percussion piping, hydraulic hammer damper, a hydraulic oscillation generator, working and runoff shafts, and rotating joints are mounted. Movement of the shafts can be implemented by remote control or by automatic remote control. A coal column up to 10 m wide can be worked by the impulse hydraulic excavator water jet under 12-16 MPa of pressure. A combination damper is used in the hydraulic excavator, which prevents penetration of the hydraulic impact waves into the main pipeline, and a system of automatic oscillation of the hydraulic excavator in the horizontal and vertical planes is also used.

New Flight Conveyor Line Pans

Line pans for a mobile SP-301 face flight conveyor have been put into series production at the Krasny Luch Machine Building Plant. The pan displays welded construction from the bottom, the two sides are specially contoured, and there are two skids. The bottom has wear-resistant surfacing and a bar which is formed jointly with the adapters, and the cover is on the seams of the conveyor chute, which prevents coal from spilling onto the lower run of the conveyor. Toward the ends of the side-members there are welded wear-resistant adapters made of high-manganese steel, which permit increased service life for the pans and provide a cover for the joint when the conveyor flight bends. To the side-members of the pan they have welded supports and strips to which is affixed mounted equipment or the hydraulic drive unit. The skids are welded to the side-members, which makes it easier to move the pans, and the conveyor as a whole. Boltless joints are used to join the pans.

12659
CSO: 1822/22

SELECTED SYNOPSES OF ARTICLES IN UGOL' UKRAINY, AUGUST 1984

Kiev UGOL' UKRAINY in Russian No 8, Aug 84 pp 47-48

UDC 37.01:622.273.23

IMPROVEMENTS IN SKILLED WORKERS' TRAINING

[Synopsis of article by M. M. Shkodin in UGOL' UKRAINY No 8, 1984 pp 2-3]

[Text] An analysis of training for skilled workers. Suggestions for its improvement.

UDC 622.013:65.011.42 "Mine imeni GAZOVYYE IZVESTIYA"

LABOR ACHIEVEMENTS OF THE IMENI GAZETA 'IZVESTIYA' MINE COLLECTIVE

[Synopsis of article by A. S. Drabik in UGOL' UKRAINY No 8, 1984 pp 4-6]

[Text] Mining geological and mining technical working conditions at the imeni Gazeta "Izvestiya" mine, of the Donbassantratsit Association. Equipment used at the faces, elimination of weak points, improvements, the search for production reserves. Mining results. 1 table, 3 illustrations.

UDC 622.232.658.387 "Mine im. 50-letiya SSSR"

WORK EXPERIENCE OF THE GROZ BRIGADE FROM THE IMENI 50-TH ANNIVERSARY OF THE USSR MINE

[Synopsis of article by Ye. I. Ivanova in UGOL' UKRAINY No 8, 1984 pp 6-7]

[Text] Technical and economic indicators at a longwall equipped with a KM-87e complex. The organization of work in M. V. Gerasimov's brigade. 2 illustrations.

UDC 622.272.8 "Severnaya Mine"

PUTTING ACHIEVED PRODUCTION CAPACITIES INTO OPERATION AT THE "SEVERNAYA" MINE

[Synopsis of article by V. I. Mordasov in UGOL' UKRAINY No 8, 1984 pp 8-10]

[Text] A combination of measures guaranteeing that established production capacities are put into operation at the Torezantratsit Association's "Severnaya" Mine. 1 table, 2 illustrations.

UDC 622.232.8.001.86:551.2/.3

GOBBING OPERATIONS AT SECTION NO 27 AT MINE NO 10

[Synopsis of article by V. I. Drogal'tsev in UGOL' UKRAINY No 8, 1984 pp 10-11]

[Text] Organization of labor at section No 27, Mine No 10 of the "Kholodnaya Banka" Mining Administration, Sovetskugol' Association. Technical and economical indicators. 1 illustration.

"UDC 622.28.004.5 "Mines im. Stakhanova"

PROTECTION OF WORKINGS WITH RUBBLE BELTS AT THE IMENI STAKHANOV MINE

[Synopsis of article by Yu. I. Samokhvalov in UGOL' UKRAINY No 8, 1984 p 12]

[Text] Experiment in keeping workings in operating condidtion behind an active longwall with rubble belts raised by a PZK crushing and stowing complex at the Krasnoarmeyskugol' Association Mine imeni Stakhanov. 1 illustration.

UDC 622.281.001.5

CONDITION AND MAINTENANCE OF WORKINGS AT MINES IN THE DONETSK-MAKEYEVKA REGION

[Synopsis of article by K. V. Koshelev, Yu. A. Petrenko, and A. O. Novikov in UGOL' UKRAINY No 8, 1984, pp 13-14]

[Text] Results of the condition of workings, deadlines and costs for repair operations. 1 table, 1 illustration.

UDC 622.232.8:622.831.1

TECHNIQUES OF EVALUATING RELIABILITY IN CONTROLLING DIFFICULT-TO-CAVE ROOFS AT LONGWALLS

[Synopsis of article by A. F. Borzykh in UGOL' UKRAINY No 8, 1984 pp 14-15]

[Text] Method of determining indicators for a resultative evaluation of the effectiveness of using processes, methods and control means with difficult-to-cave roofs at comprehensively mechanized longwalls. Indicator is recommended for correction of the coefficient of reliability of work at breakage faces while developing thin, gently-dipping seams. 1 reference.

UDC 622.013:658.3.015.25

INCREASING LABOR PRODUCTIVITY BY IMPROVING THE ORGANIZATION OF PRODUCTION

[Synopsis of article by S. A. Saratikyants in UGOL' UKRAINY No 8, 1984 pp 16-17]

[Text] Report presented at the 5th Plenum of the Ukrainian Governing Board, Scientific and Technical Department of Mining. Working conditions of coal enterprises, and the situation which has been created. Basic directions guaranteeing growth in labor productivity.

UDC 622.7.013

IMPROVING THE PRICE LIST FOR WHOLESALE PRICES ON DONETSK COAL

[Synopsis of article by V. P. Golovin, L. N. Voronkova and P. N. Skarbo in UGOL' UKRAINY No 8, 1984 pp 18-19]

[Text] Special features of the wholesale price list for Donetsk coal, introduced in 1982, its importance for increasing the effectiveness of concentration. Evaluation of discounts (allowances) for ash content, wetness and sulfur content in coals. Recommendations for improving the wholesale price list. 2 tables, 2 references.

UDC 658.387.4:622.33

MULTIHOLE BRIGADE FORM OF LABOR ORGANIZATION

[Synopsis of article by A. A. Nosal' in UGOL' UKRAINY No 8, 1984 p 20]

[Text] Organization of labor in GROZ brigades working at two or three breakage faces. Its advantages in comparison with organization when working at a single face.

UDC 622.023.68

USING BUCKET-TYPE CUTTING WEDGE MACHINES AT UkSSR MINUGLEPROM MINES

[Synopsis of article by V. F. Kompanets, A. Ye. Margulis and Yu. P. Sidorov in UGOL' UKRAINY No 8, 1984 pp 21-22]

[Text] Technical characteristics, analysis and results of time study observations of A1030 and D1131 cutting wedge machine operation.

UDC 622.234.5:622.23.05

HYDRAULIC DISTRIBUTOR WITH AN ELECTROMAGNETIC DEVICE FOR MINING MACHINES

[Synopsis of article by V. Ya. Poltoratskov and A. A. Yanchenko in UGOL' UKRAINY No 8, 1984 p 22]

[Text] Characteristics and results of acceptance tests of a hydrodistributor with an electromagnetic device for remote- and automated-control of mining machinery. 1 illustration.

UDC 622.532:621.5.001.4

EQUIPMENT FOR REGULATING PUMP STATIONS WITH A PNEUMATIC INSTRUMENT

[Synopsis of article by V. G. Zhuravlev and S. S. Lyumet in UGOL' UKRAINY No 8, 1984 pp 23-24]

[Text] Equipment for regulating hydraulic pressure on the outlet of a SNU5.P pump station and its preliminary and acceptance tests. Control of frequency of rotation of pneumatic motors and pumps mechanically connected to them. 2 illustrations.

UDC 622.831.322

DEVICE FOR SEALING BLAST HOLES

[Synopsis of article by V. A. Gromov in UGOL' UKRAINY No 8, 1984 p 24]

[Text] Operating principle of new simplified-design sealing device. Advantages over extant devices. 1 illustration.

UDC 622.232:65.011.54.002.7 "Komsomolets Donbassa Mine"

IMPROVEMENT IN TRANSPORT AT THE "KOMSOMOLETS DONBASSA" MINE

[Synopsis of article by S. A. Shcherbak and F. Z. Akhmedzhanov in UGOL' UKRAINY No 8, 1984 p 25]

[Text] Work methods at the mine transport section under conditions of putting capacities into operation ahead of schedule.

UDC 622.673.1:621.31:622.861

CONDITION OF ROTOR CHAIN INSULATION ON ELECTRIC MOTORS FOR HOIST EQUIPMENT

[Synopsis of article by D. I. Gertsenshteyn and G. D. Agrest in UGOL' UKRAINY No 8, 1984 p 26]

[Text] Results of research on the parameters of rotor chain insulation on hoist equipment electric motors at coal mines. 1 table.

UDC 622.445

BOOSTING MAIN VENTILATION SYSTEM VENTILATORS

[Synopsis of article by V. I. Kovalevskaya and V. Ye. Khatuntsev in UGOL' UKRAINY No 8, 1984 pp 27-28]

[Text] Experiment in increasing productivity and pressure of ventilating equipment of main ventilation systems through the use of equipment used to increase productivity and pressure of mining centrifugal ventilators. 1 illustration.

UDC 622.625.2.019

STABILIZED SUPPLY SOURCE FOR SNV-2

[Synopsis of article by Ye. S. Gaychinskiy, P. V. Natarov and Yu. M. Volkov in UGOL' UKRAINY No 8, 1984 p 28]

[Text] Operating principle of the SNV-2 stabilizor in normal and emergency conditions. Test results. 1 illustration.

UDC 622.413.4:621.575

USE OF ABSORPTION REFRIGERATING MACHINES AS AIR CONDITIONERS IN DEEP MINES

[Synopsis of article by A. I. Bobrov and V. K. Chernichenko in UGOL' UKRAINY No 8, 1984 pp 29-30]

[Text] Results of a technical and economic analysis of the use of absorptive and steam compression refrigerating machines. The field of expedient use of absorptive machines. 1 table, 1 reference.

UDC 622.831.322.001.5:681.3

METHOD OF SEISMOACOUSTIC CONTROL OF THE STRESSED STATE OF A SEAM

[Synopsis of article by B. M. Usachenko, V. K. Khokholev and A. F. Bulat in UGOL' UKRAINY No 8, 1984 pp 30-31]

[Text] Basis for an informative combination of the characteristics of the seismic activity of outburst-dangerous seams, the effect of natural and technological factors on the processes of disturbance are considered and rock-mass conditions are characterized. Method of controlling the stressed state of the seam during breakage face operations.

UDC 622.807:533.061

DUST-FORMING CAPABILITY OF COAL IN THE COURSE OF METAMORPHISM EVALUATED

[Synopsis of article by E. N. Medvedev, V. I. Saranchuk and V. N. Kachan in UGOL' UKRAINY No 8, 1984 pp 32-33]

[Text] Results of a dispersion analysis of data on dust conditions at breakage faces. Equation describing the relation of proportionate dust-formation from coals at various stages of metamorphism and moisture. 1 table, 1 illustration, 1-title bibliography.

UDC 622.831.322:622.267.53

EFFECT OF THE LITHOLOGIC COMPOSITION OF INTERSEAM ROCKS ON BLOWOUT DANGER OF SEAMS IN PGD [possibly--Maximum hydrostatic pressure] ZONES

[Synopsis of article by Yu. V. Megel', S. A. Lar'kov and A. G. Averbukh in UGOL' UKRAINY No 8, 1984 pp 33-34]

[Text] Results of research on the effect of sandstones on blowout danger from seams in PGD zones. The presence of sandstones lowers the intensity of the adverse effect of bearing loads on the blowout danger of contiguous seams. Nomograph for calculating this effect. 2 illustrations. 1 reference.

UDC 622.794.3

DETERMINATION OF SLUDGING INDICATORS DURING ENRICHMENT OF COALS IN AN AQUEOUS MEDIUM

[Synopsis of article by P. P. Zhukov, Z. V. Minchenko and N. Ya. Nesterova in UGOL' UKRAINY No 8, 1984 pp 34-35]

[Text] Laboratory method of testing coals in an all-metal drum, providing a satisfactory simulation of the sludging process in an aqueous medium. Method of calculating indicators for additional sludge formation and correction for fractional composition of coal. 1 table.

UDC 622.741.3:621.928.028.1

INVESTIGATION OF HYDROPREPARATION OF RUN-OF-MINE COALS

[Synopsis of article by A. D. Polulyakh in UGOL' UKRAINY No 8, 1984 p 36]

[Text] Research results of hydropreparation run-of-mine coals. Formula for determining flow speed of material after hydropreparation with regard to the technological, hydrodynamic and structural factors. 1 illustration.

UDC 622.031.001.18

PREDICTION OF FINE-AMPLITUDE COAL SEAM DISTURBANCE

[Synopsis of article by V. S. Baranov, V. V. Shmelev and I. A. Kryuchkov in UGOL' UKRAINY No 8, 1984 pp 37-38]

[Text] Use of the multivariate mathematical modelling method on a computer for prediction of fine-amplitude disturbance of a coal seam in the Rostovugol' Association imeni Lenin Mine field. 1 illustration.

UDC 622.02:551.311.6

SEISMOACOUSTIC METHOD OF PREDICTING OF REPLACEMENT AND INTRUSION OF ROCKS IN COAL SEAMS

[Synopsis of article by A. I. Komarov, Yu. S. Isayev and Ye. A. Vlasenko in UGOL' UKRAINY No 8, 1984 pp 38-40]

[Text] Fundamental tenets of a methodology of observations and equipment, and results of predicting rock intrusion in coal seams by the seismoacoustic method. Effectiveness of using this method. 1 illustration. 2 references.

UDC 628.517.2:622.23

IMPROVING SERVICE PROPERTIES OF SHAFT-SINKING MACHINES

[Synopsis of article by V. G. Nesterenko, V. A. Kozachenko and L. A. Geshlin in UGOL' UKRAINY No 8, 1984 pp 41-42]

[Text] Methods of improving service properties of drilling equipment and loading machines used in sinking vertical mine shafts.

UDC 622.257.1:624.138.41

DETERMINING THE DISSEMINATIVE RADIUS WHEN INJECTING SOLUTIONS INTO ROCKS

[Synopsis of article by N. V. Mamontov and Yu. A. Veselov in UGOL' UKRAINY No 8, 1984 pp 42-43]

[Text] Basic mining technical factors affecting the disseminative radius of polymer solutions. Nomogram, permitting an integrated evaluation of the effect of factors and a prediction of results of plugging. 2 tables. 1 illustration.

12659
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SARATOV OBLAST FUEL CONSERVATION PROGRAM OUTLINED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 8, Aug 84

[Article by V.Gusev, first secretary, Saratov obkom of the CPSU: "Fuel and Energy Resources Must Be Used Effectively and Thriftily"]

[Text] At the present stage the development of the economy calls for an increase in the production of fuel and electricity. This is one of the most important trends in the matter of enhancing the effectiveness of the national economy.

The 26th congress of the CPSU and subsequent plenums of the CPSU Central Committee reaffirmed the fact that the development of heavy industry and its basal fuel and energy sectors is an unconditional prerequisite for the solution of all production and social problems.

In compliance with the CPSU and USSR Council of Ministers decree "On intensifying efforts to economize and rationally utilize raw material, fuel, energy and other material resources", practical measures are currently being implemented in the national economy to significantly lower the consumption of fuel and energy, raw and semifinished materials, reduce industrial waste and expand the utilization of secondary resources.

The Energy Program of the USSR mandates an improvement in the structure of the energy balance, a reduction in it of the relative weight of petroleum products and their replacement by nuclear and hydraulic energy (in certain regions of the country - by gas and coal); utilization of the energy of the sun, the wind and other non-traditional sources; the creation of a reliable system of energy and natural resources conservation.

The problem of economy and thrift is an economic problem, but a political and moral problem as well. The Saratov oblast party organization always bears this in mind as it pursues its drive for effective utilization of resources, a drive that calls for concrete, multifaceted efforts in all areas of the national economy, including production, consumption and management.

Saratov oblast is endowed with major industrial and agricultural potential. This is oil and gas-producing country; a pipeline

system carries substantial amounts of oil and gas produced in other regions of the country; widely used are the hydroresources of the Volga river. All this fully satisfies our requirements in electric and thermal energy. In fact, part of the electricity we generate is channeled into the country's unified energy system.

The oblast has seven power stations with an overall capacity of 2.75 milliom kwts - the Saratov hydroelectric power station (GES) of 1.36 million kwts and six thermal stations (TES) of 1.39 kwts overall. Under construction is the Balakovo atomic power station (AES) whose first block of 1 million kwts is to be commissioned this year. A major pumped storage power station (GAES) is currently in the design stage. Long-range plans envision the utilization of local shalerock.

However, the demand for energy resources is constantly growing. That is why the effective and economical use of fuel, thermal and electric power has become a top-priority task identical in its impact to an increase in their production, and a very substantial one at that.

The oblast has gained a certain amount of experience in organizational and mass political work aimed at mobilizing labor collectives to search for untapped reserves in the matter of conserving electric and thermal energy and heightening the reliability of energy deliveries to the various sectors of the economy and the population. These issues are regularly reviewed by the CPSU obkom and the oblispolkom, at meetings of party gorkom and raykom bureaus, by ispolkoms of city and rayon soviets of people's deputies, people's control committees, at party, trade union, komsomol and workers' meetings in enterprises and organizations.

The obkom of the CPSU issued a number of decrees aimed at strengthening the party's influence in the campaign to further develop energetics and heighten the effectiveness of fuel and energy utilization. The obkom demands of party committees and management personnel that they work toward specific goals, pinpoint their objectives and ways to attain them, utilize all means, forms and methods. This work is being carried out with consistency and is coordinated by the CPSU obkom.

The organizing and guiding document for all party committees, enterprises and organizations in the oblast is a comprehensive plan of practical measures to raise the effectiveness of fuel and energy utilization, abide by the ground rules for electricity consumption in autumn and winter and enhance the reliability of electricity deliveries in light of the decisions adopted by the 26th congress of the CPSU for 1981-1985. A similar plan was in effect during the tenth five-year plan period.

This document lists four basic directions in the drive to conserve fuel and energy resources.

Enhancing the reliability of electricity supply

This work is based on measures to develop generating capacity, impart an added reliability to the work of electric power stations, improve the energy facilities of all enterprises and city utilities and expand the electrification of agriculture. The central task in this area is to ensure reliable power supply by reserving capacity, ringing power lines, introducing control and regulating instruments and making wide use of automatic reserve input and repeated switch-ons.

To that end during the first 3 years of the 11th Five-Year Plan electric power station capacity went up 11 percent to 2.75 million kwts, total power-line length by 12.6 percent to almost 59 thousand kilometers. As a result every rayon center in the oblast has a doubled or tripled electrosupply system. Electricity output was upped 12 percent to 13 billion kwt/hrs.

Particular attention is paid to raising the technical level of plant energy facilities, for which purpose they were all subjected to a thorough investigation.

In the last three years in industry alone 30 new plant substations were commissioned; 87 percent of all enterprises are equipped with automatic mechanisms for switching on surplus electricity. The number of enterprises with backup electrosupply is now 95 percent, in the leading industries - the chemical, petrochemical, machine-building - the figure is 100 percent.

An important issue is stability in the supply of electricity to those rural communities who get it from the state energy network. The provision of electricity to the agriculture of the oblast in the current five-year period rose by 14 percent and stood in 1983 at 1.8 billion kwt/hrs, with 80 percent of it going for production needs. The electrification of the oblast is proceeding at a pace which allows to expand the acreage of irrigated lands.

The power-worker ratio in agriculture has grown by 40 percent since 1975 and today stands at 3970 kwt/hrs per worker. New power lines are being erected on a massive scale and old ones reconstructed, all are undergoing ringing and their icicle and wind protection are being improved. Two thirds of these lines have two-way input, with plans for bringing that ratio up to 100 percent in the next two to three years.

Implementation of the above-listed and other measures has led to a reduction during the current five-year plan of emergency switch-offs by one-third and to greater reliability in energy supply.

When the first unit of the Balakovo AES is commissioned in the 11th Five-Year Plan the oblast's power station capacity will

go up by 50 percent and electricity output by 29 percent (to 15 billion kwt/hrs).

Raising the effectiveness of fuel and energy utilization

In the drive to raise the effectiveness of fuel and energy utilization the obkom, the gorkoms, raykoms of the CPSU and all primary party organizations lay special emphasis on mobilizing labor collectives to lower the relative consumption of fuel that goes into the production of electricity, thermal energy and finished goods. The party committees encourage enterprises and organizations, their engineering departments, specialists and innovators to develop energy-saving technological processes and install energy-efficient equipment.

In 1983 the power stations of our oblast used 265 grams of standard fuel to produce 1 kwt/hr of electricity, which is 63 grams less than the average for the Ministry of Power and Electrification.

The oblast is currently applying the experience and initiative of our leading plants to introduce automated control of energy consumption, determine the optimal modes of energy input into technological processes (structural analysis of energy consumption) and increase output of goods without upping the prescribed limits on energy resources.

A substantial part of the energy conserved must be credited to the introduction of progressive technology and to design and technological improvements aimed at reducing energy consumption by the production process.

The main criterion in evaluating the effectiveness of fuel and energy utilization is reduction of energy consumption per unit of goods produced. Developed by the enterprises and currently in wide use is a method known as structural analysis of energy consumption which boils down to determining the optimal mode of energy input after detailed analysis of the technological process.

At the present time oblast administrations and departments, enterprises and organizations are undertaking measures to reduce energy input per unit of goods produced. In the first 3 ½ years of the current five-year plan State Ball Bearing Plant No.3 lowered its relative expenditure of energy by 14.5 percent after putting through organizational and technical measures prompted by such an analysis.

The collective of the Saratov Electrical Equipment Production Association developed optimal, technically sound limits on energy expenditure for every one of its structural subdivisions and installed an automated system called Energetik to monitor, plan and operationally influence the consumption of energy. Between 1976 and 1983 the volume of production at this association increased 1.8 times, whereas the relative input of energy came down by more than 1.5 times.

The decisive factor in reducing energy consumption in the chemical, oil refining and petrochemical industries is continuous technical modernization on the basis of the latest achievements of science and technology. The Saratov production association "Nitron", for example, redesigned its production of nitrile of acrylic acid, introducing a technological process that eliminated two stages in the making of the necessary primary materials thanks to which three quarters of the heat generated is reutilized for technological needs. In the last seven years the association's output increased 1.8 times, at the same time the normative expenditure of electricity was reduced 1.6 times and of thermal energy by 9 percent.

Another example. The Oil Refinery imeni S.M.Kirov introduced a combination system which merged several oil-refining processes into one. This led to a 38 percent increase in output and a concurrent drop in the relative consumption of electricity of almost 14 percent and in thermal energy of 15 percent.

As a result of systematic and determined efforts, relative expenditure of electricity in the oblast is diminishing year after year. Compared to 1975 these outlays have been reduced in industry as a whole by 11 percent, including 18 percent in machinebuilding, 19 percent in the light and food industries and 23 percent in the chemical and gas industries. The rate of growth in the output of goods is almost double that of the expenditure of electricity for their production.

An important aspect of the drive for rational utilization of fuel is liquidation of small boiler rooms and the organization of centralized deliveries of heat from heat and power stations (TETses). In the last few years over 300 old boiler rooms were closed down and 250 low-efficiency ones excluded from construction plans, leading to a savings of over 130 thousand tons of standard fuel.

Management and specialists have been advised to use secondary energy resources and industrial waste. In the tenth and current five-year plan periods the number of enterprises using secondary energy resources quadrupled to 80; today they account for an annual savings of about 1 million hectocalories of thermal energy.

Used as secondary energy resources by the enterprises and organizations of the oblast are the following: oil refining and chemical industry byproducts in the form of combustible gases, the heat of escaping gases from technological installations, spent steam and, finally, condensates.

The gaseous byproducts of the Oil Refinery imeni S.M.Kirov and the production association "Nitron" which were previously burnt are now used as fuel by Saratov TETs-2. In the course of the 10th Five-Year Plan it used the equivalent of 485 thousand tons of fuel from these byproducts, thereby saving 350 thousand tons of fuel oil. For

the first 3 years of the current five-year plan the corresponding figures are 341 thousand tons of standard fuel and 251 thousand tons of fuel oil.

Using the heat of gases escaping from the kilns of their chemical subdivisions to produce steam in utilizer boilers, the Balakovo production association "Khimvolokno" and the Chemical plant save 450 thousand hectocalories of thermal energy each year.

At the production association "Nitron" the heat of gases emitted during the production of alcohol is channeled into utilizer boilers, which made for a reduction in the expenditure of TETs-supplied heat by 280 thousand hectocalories a year. At full scale production of nitrile of acrylic acid heat expenditure is cut by an additional 800 thousand hectocalories annually. At the Oil Refinery imeni S.M.Kirov the heat of escaping gases from technological installations is used in utilizer boilers to generate steam, in recuperators - to warm the air, the spent steam is used to desalinate the petroleum. This allowed the refinery to lessen its consumption of TETs heat by 138 thousand hectocalories a year. The Balakovo Automotive Earth-Digging Machinery Plant uses gases escaping from the heating furnaces of the forge shop to warm the air in the recuperators, resulting in a savings of 300 thousand hectocalories annually.

Animal husbandry is expanding the introduction of electrotechnological processes, automatic lighting control systems, electroheating of floors, all electric motors are being brought into accord with mechanism capacities, incandescent lamps are replaced by mercury and fluorescent lamps, the transformer substations of threshing floors, the vitamin-flour and granulated-fodder manufacturing machines are now subjected to seasonal switch-off. The introduction has begun in the current five-year plan of electricity-consumption norms. All these measures add up to an annual savings of about 11 milliom kwt/hrs.

Of great importance in the ongoing drive for rational, economic use of fuel and energy in transportation which consumes half of all liquid fuels. The collective of the Volga Railroad is working to improve the technical level of its equipment, modernize the locomotive park, better the utilization of its rolling stock, raise the qualifications of its locomotive repair teams, streamline norm setting and record keeping, reduce fuel losses during its unloading and storage. Each year comprehensive plans are drawn up aimed at saving energy. Every month and quarter the consumption of energy is analyzed, instances of its waste and losses are pinpointed and measures are suggested for its conservation, shortcomings are eliminated.

The railroad's compliance with norms and its fulfilment of directives concerning the consumption of diesel fuel, electricity and thermal energy are continuously monitored.

Organized in the locomotive depots over the first 3 years of the 11th Five-Year Plan were 165 advanced training schools. Here over 1500 locomotive engineers were taught economical ways of driving a locomotive which entailed about 10 thousand trips with trainers and instructors. Specialists and activists inspected 1544 locomotives with abnormally high consumption of fuel or electricity. Another factor conducive to fuel and electricity conservation is the yearly incorporation into production of a significant number of technical measures.

Thanks to all these efforts by the collective the railroad has over the past 3 years of the 11th Five-Year Plan achieved a savings of 88.4 million kwt/hrs of electricity and 40.1 thousand tons of diesel fuel. The overall economy was 4 million rubles.

Much is being done by the territorial association "Saratovavtotrans" which is concentrating its efforts on developing its production and technical base, improving the exploitation of rolling stock through computerization and better record-keeping. For the current five-year plan the association has drawn up a plan of organizational and technical measures to conserve fuel and energy and a comprehensive program to save automobile fuel. Measures are under way to improve the work of the technical, operational, personnel and economic sectors. It is well known that a technically defective automobile is a potential avenue of fuel and lubricant overexpenditure. That is why most of the effort is directed at improving the technical condition of the automobiles. Each year 5-6 million rubles are allocated for the development of the association's production base.

At the present time 25 motor transport enterprises service their vehicles in standard modern buildings equipped with all the necessary mechanisms and tools. In the past three years of the eleventh five-year plan they have acquired and incorporated into production 16 stands for testing and adjusting fuel systems, 47 gasalyzers are in operation to check the composition of exhaust fumes. The enterprises now have heated indoor parking space and heating systems to accomodate 6500 vehicles.

Serious attention is paid to increasing rolling-stock run between repairs and conserving fuel and lubricants during technical maintenance and repairs. A substantial contribution to energy conservation is made by rationalizers, inventors and instructor-drivers.

"Saratovavtotrans" is working hard to perfect its system of centralized regulation of agroproduce haulage. The system has been functional in all Saratov oblast rayons since 1981, operating in the "field - threshing floor - elevator" mode. Computer-developed hourly schedules for the vehicles and for grain deliveries to the receiving points make for a rise in productivity, a reduction in haulage costs and additional savings of fuel and lubricants.

The work accomplished in the 3 years of the five-year plan has resulted in savings by the association of 10.6 thousand tons of gasoline, or 2.5 percent, and 3.3 thousand tons of diesel fuel, or 1.7 percent of the limit prescribed.

Among those taking an active part in resolving the problem of raising the effectiveness of fuel and energy utilization are oblast VUZ workers and sectorial scientific research institutes - about 600 scientists and research workers in all, including 9 doctors of sciences and professors and 110 candidates of sciences. Their studies are conducted in the framework of specific and comprehensive scientific and technological programs developed by the State Committee for Science and Technology. The fundamental and applied research being done has as its goal the creation of new kinds of machinery for the production of electricity and thermal energy, comprehensive electrotechnological utilization of solid fuels, the development and incorporation into production of new, highly effective methods of utilizing electricity, fuel, heat and secondary energy resources, the creation of energy-saving technological processes and an overall reduction in the energy-intensity of production.

Saratov oblast perseveres in implementing a long-range program known as "Energy Economy" and developed by a scientific advisory board established by the CPSU obkom. This program is aimed at developing the energy sources of the oblast, heightening the effectiveness of energy-generating machinery, perfecting the patterns of energy deliveries and consumption, creating energy-saving technological processes and carrying out organizational and technical energy-conserving measures.

Several scientific organizations of our oblast have drawn up a scientific program entitled "Volga Shale" which directs several faculties of the Saratov Polytechnical Institute to research the prospects for expanding the use of combustible shales in the economy.

Improving control over in-limit consumption of electricity

Attention here is focussed on strict observance by all enterprises and organizations of limits and norms imposed on energy consumption, as well as the technical validity of those norms. The energy consumption pattern is rigorously controlled. A system of information and decision-making has come into being at every level of party leadership.

Analysis of the state of affairs in energy consumption by the enterprises is carried out by competent commissions. Reports on these issues by plant managers and party committees are presented and discussed in the relevant departments of the CPSU obkom.

The observance of plan discipline in the matter of fuel and energy consumption is controlled, in addition, by an oblispolkom inter-

departmental commission on conservation and rational use of material resources and by local ispolkoms and organs of people's control. Thus, over 70 percent of electricity and heat consumption is under daily control, and one half is monitored every hour. An operational dispatcher service was organized to see that energy consumption stays within prescribed limits and technical parameters. 150 volunteers were trained to carry out the duties of State Energy Surveillance inspectors. Enterprises which go over the limit on energy consumption are served warning cards.

As a result of continuous control and swift remedial action the number of enterprises that permit overexpenditure of energy to happen has been reduced to a minimum; the oblast as a whole has an uninterrupted string of successes in the matter of saving electricity, thermal energy and fuel; the immediate task is to have every enterprise and organization without exception staying within prescribed limits for energy consumption and conserving energy resources.

Mass organizational support, propaganda and assimilation of advanced know-how and valuable initiatives in the matter of raising the effectiveness of fuel and energy utilization

The obkom of the CPSU and the party committees attach great importance to these issues. Party and soviet organs of every level, all labor collectives in the oblast are constantly thinking about how to conserve electricity, heat and fuel, how to best ready the economy for the fall-winter period. Mass-political and organizational measures are approved based on the results of the previous winter. Preparations for the winter begin in April, in August they are reviewed by the party and economic aktiv of the oblast, in cities and rayons and at meetings of labor collectives. Contests and reviews of energy conservation reserves and energy supply reliability are held regularly, as are scientific and practical conferences and seminars.

On the second Tuesday of each month the oblast conducts a massive check on energy conservation measures in which up to 30 thousand people take part. These drives play an important role not only in discovering instances of irrational utilization of energy, but in their prevention as well. When the campaign is actually in progress the consumption of electric and thermal energy drops by 2-3 percent of the usual daily expenditure. Currently being introduced at the enterprises are individual energy conservation accounts.

Another form of evaluating and rewarding the work of leading enterprises which has proved quite effective is the issuance of warranty passports certifying the plant's preparedness in the matter of energy conservation. These passports carry a certain prestige for the collective concerned. The possession of such a passport is taken into account when selecting winners of contests and reviews

on rational use of fuel and energy. They are issued annually by special commissions in the period between April 1 and September 1. Last year 600 enterprises and organizations which together account for over half of the oblast's energy consumption were issued warranty passports.

A collective's good showing, its suggestions and initiatives are, as a rule, studied by party and soviet organs as well as specialists, then reviewed by the party committee, party bureau and technical council of the enterprise where the movement got its start. Given a positive assessment, the suggestions are sent out to the party committees of the oblast, the cities and the rayons to be incorporated into production.

At the initiative of the CPSU obkom widespread circulation was given in the oblast to the achievements of State Ball-Bearing Plant No.3 and the Saratov Electroapparatus Production Association in the matter of reducing the relative expenditure of electricity and heat through structural analysis of energy consumption, incorporation into production of energy-efficient technological processes and equipment, improvements in the tally and planning systems and in rapid reaction upon the energy consumption process.

A joint initiative by the Saratov production association "Nitron" and the Oil Refinery imeni S.M.Kirov was weighed and approved by the bureau of the CPSU obkom in 1982. It called for an increase in output without any increase in fuel and energy allocations. In 1981-1982 157 industrial enterprises which accounted for 53 percent of the oblast's consumption of electricity switched to the new method. In 1983 an additional 80 collectives achieved growth in output without increasing their expenditure of electricity.

All achievements in the drive to heighten the effectiveness of fuel and energy utilization are regularly publicized in oblast, city, rayon and plant newspapers, on radio and TV and by means of visual propaganda. Information is regularly presented on the progress of the oblast-wide competition for conservation of electricity, as are bulletins detailing the achievements of the more successful enterprises. The oblast newspaper KOMMUNIST conducts "round-table" conferences where participating enterprises exchange information on the subject.

The problem of fuel and energy conservation figures prominently in the system of workers' economic education, refresher courses of all kinds and in work with rationalizers.

Each year the oblast sponsors a thematic contest for the best invention and rationalization proposal. In 1983 the incorporation into production of proposals submitted to the contest resulted in a savings of 15.9 million kwt/hrs of electricity, 56.9 thousand hectocalories of heat and about 2 thousand tons of standard fuel.

Conservation and rational use of fuel and energy resources are widely reflected in the socialist obligations of individual workers and entire collectives, play no mean role in evaluating performance and are morally and materially rewarded.

In the 3 years of the 11th Five-Year Plan the enterprises and organizations of the oblast have implemented over 7.7 thousand organizational and technical measures, achieving an economy of 489 million kwt/hrs of electricity, 2146 thousand hectocalories of heat and 190 thousand tons of standard fuel.

In sum, it can be said that the oblast's method of heightening the effectiveness of fuel and energy utilization has in the 10th and 11th Five-Year Plans produced positive results. However, the oblast party organization has no intention of resting on its laurels. Much remains to be done, and there are difficulties and shortcomings to be overcome. With the growth and development of the economy and higher living standards among the population the rational use of fuel, heat and electricity becomes a more complicated process in both the factory and the home.

The Saratov oblast committee of the party attaches great importance to the systematic and purposeful education of all toilers to understand the specific character of energy production and consumption. This was reiterated by General Secretary of the CPSU Central Committee, Chairman of the Presidium of the USSR Supreme Soviet K.U. Chernenko in his speech at a meeting with workers of the Moscow plant "Serp i Molot" on April 29, 1984: "Only the initiative, the personal contribution of each, from worker to director, to advancing the cause of thrift and economy in every field of endeavor will yield tangible results."

The CPSU obkom is directing the efforts of party committees to seek new and better ways of leading the drive for effective utilization and economy of fuel and energy resources in light of the demands of the 26th party congress and subsequent plenums of the CPSU Central Committee.

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